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TERRA NOVA NATIONAL PARK
RESOURCE DESCRIPTION AND EVALUATION

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Terra Nova National Park
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ABSTRACT

Terra Nova National Park is described and both park objectives and natural resource management objectives outlined. A description and evaluation of the park's climate is provided. An Ecological Land Classification applied to the park provides an appropriate background for portrayal of its natural resource components. These components include: hydrology, geology, geomorphology, soils, flora, mammals, avifauna, amphibians, freshwater and anadromous fish, terrestrial and non-marine invertebrates, intertidal marine invertebrates, and fish. A discussion of the archaeology and human history of the park is included. The opportunities and limitations for interpretation of each natural resource component is evaluated and scientific interest, if applicable, noted.

RÉSUMÉ

Le présent document offre une description du parc national de Terra Nova et expose à la fois les objectifs du parc et les objectifs qui ont été établis en matière de gestion des ressources naturelles. On y trouve également une description et une évaluation du climat du parc ainsi qu'une classification écologique du territoire qui fournit des renseignements utiles sur les éléments constitutifs des ressources naturelles du parc: hydrologie, géologie, géomorphologie, sols, flore, mammifères, avifaune, animaux amphibies, poissons d'eau douce et anadromes, invertébrés non marins et terrestres, invertébrés marins de la zone intertidale et poissons de mer. Le document traite aussi de l'archéologie et de l'histoire du parc et évalue les possibilités et les limites qui se présentent en matière d'interprétation de chaque composante des ressources naturelles, en soulignant, s'il y a lieu, tout élément d'intérêt scientifique.

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Section I

INTRODUCTION

The Terra Nova National Park Resource Description and Evaluation is a digest, analysis, and evaluation of all pertinent natural resource information contained in the park data base. It highlights major issues and concerns reflecting a strong bias toward past and ongoing process. It constitutes the primary resource management contribution to the Park Management Planning Process and will serve as an ongoing reference tool for other management applications. It may also serve as a public information source to assist in the presentation and subsequent understanding of the park.

Terra Nova National Park Objectives

The objectives of Terra Nova National Park provide the framework and guide for preserving park resources, for interpreting the values of the park, for accommodating environmentally compatible public use, for directing park operations and for integrating the park into its regional environment. Administrative decisions concerning the management, use and development of the park are directed toward achieving the objectives within the mandate of Parks Canada. These six objectives have been classified under the following headings: Natural Resource Preservation and Management; Cultural Resources Preservation; Interpretation and Communication; Visitor Use and Enjoyment; Administration; and, Regional Relationships.

1. Natural Resources Preservation and Management: To preserve and manage the natural features and processes of Terra Nova National Park within its integral marine setting as representative of the Eastern Newfoundland Island Atlantic Natural Region through the application of sound resource management and planning principles.

2. Cultural Resources Preservation: To protect representative examples of the cultural heritage resources left by man's presence in the area prior to establishment of the park.

3. Interpretation and Communication: To install in the public, both inside and outside Terra Nova National Park, an ecological and cultural awareness and an appreciation of the values, policies, and philosophy of Parks Canada, and the significance of Terra Nova National Park itself.

4. Visitor Use and Enjoyment: To ensure the provision of a variety of compatible facilities and outdoor recreational activities and services which will permit the park user to experience and enjoy Terra Nova National Park and the adjacent area.

5. Administration: To manage the park efficiently and effectively; ensuring convenience and safety in the use and enjoyment of the facilities, activities and services; and, fulfilling the objectives, policies, directives and programs of the Department.

6. Regional Relationships: To ensure responsible planning, development and management with the park's geographic and economic zone of influence, through the cooperative efforts of individuals within the region and park personnel.

Terra Nova National Park Description and Role

Terra Nova National Park protects for all time a natural area of Canadian significance representative of the Eastern Newfoundland Island Atlantic Region. Located on the eastern shoreline of Newfoundland, the lands of the park are part of the Appalachian mountain system. Established in 1957, it is accessible by travelling 75 kilometers east from Gander along the Trans Canada Highway. The park covers an area of approximately 400 square kilometers and includes a 160-kilometer stretch of coastline. The topography, geology and glacial history combine to create three distinct areas in the park. The western part is dominated by elongated drumlinoid hills while the eastern region is characterized by sedimentary rock formations of precambrian age, devoid of glacial deposits. The central portion is somewhat intermediate, with shallow tills sculpturing the rough contours of the bedrock. The shoreline of the park is remote and rugged with rocky headland cliffs, sheltered coves and cobble beaches.

A boreal forest with black spruce, balsam fir, white birch and poplar is characteristic of the park. Alder and red maple grow in the stream valleys. Various types of bogs and fens occur throughout the park which support plants such as bog laurel, leatherleaf, pitcher plant and Labrador tea.

Bald Eagle and Osprey nest in the park, and on an infrequent basis, the park provides shelter for some migrating European birds that get blown off course during severe storms. The mammal species found in the park include both native and introduced species. Native species include beaver, meadow vole, black bear, otter and lynx. Introduced species include the masked shrew, snowshoe hare, mink, moose and squirrel.

The human history is tied to the park's location on the east coast of Newfoundland and includes that of the Paleo-Eskimo, Dorset Eskimo, Maritime Archaic and Beothuk Indians, all of which are now extinct. There are also less significant historical resources relating to colonization by Europeans, such as evidence of lumbering and fishing as carried out during the late 1700's.

Specific forest, fen and wetland areas deserve special protection measures for the plant and animal communities they preserve. There are several rare plant and animal species in Terra Nova, such as Arctic Blueberry, Curly Grass Fern, Bald Eagle, and Osprey.

The park encourages public understanding of the meaning and value of its natural and human heritage, the philosophy of Parks Canada, and the ecological importance of preserved natural areas. Some of the special processes and associated themes which have been identified to interpret are:

1) the power of a dynamic ocean, as represented by the Labrador Sea and Bonavista Bay, and its great influence on - and multi-various interactions with - the land mass of the park;

2) a land mass sculptured by glaciers leaving behind deposits of sand, gravel, and large boulders;

3) the dynamism of a boreal forest significantly influenced by close proximity to the North Atlantic;

4) the formation and evolution of freshwater lakes and bogs, such as Gross Bog and Salton's Bog, left after the retreat of the glaciers.

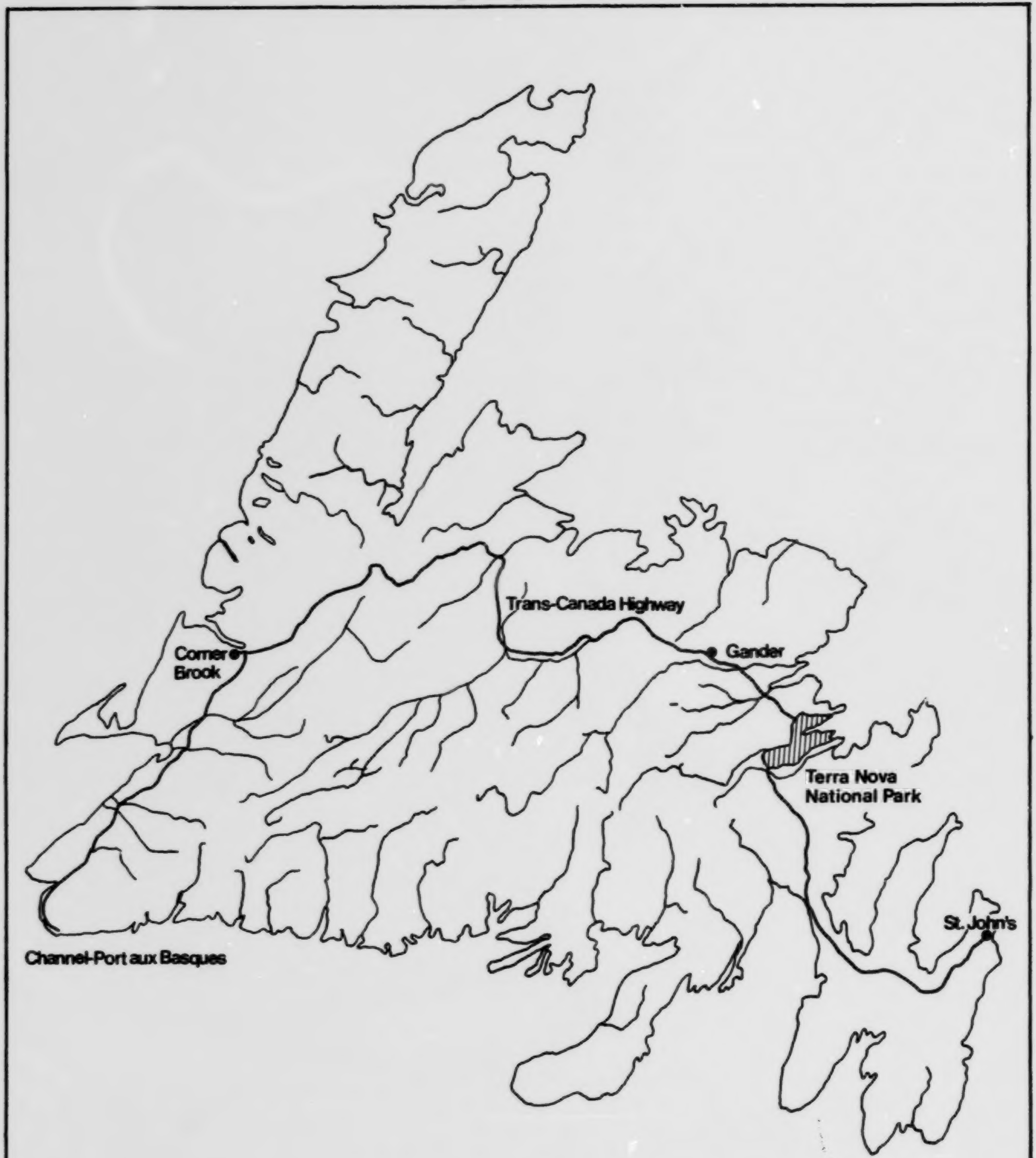
The coastal life is an inseparable part of Terra Nova National Park. Seals, Atlantic White-sided dolphins, otters, humpback whales, pilot whales, fin whales, Arctic sunfish, schools of capelin, mackerel and herring and runs of squid are all very much a part of the natural values that are interpreted within Terra Nova National Park.

Charlottetown, a small fishing community, is included as an enclave within park boundaries. The towns of Gander, Clarenville and Bonavista are the largest concentrations of population within a 50-mile radius. Approximately 8,000 people live in smaller communities adjacent to park boundaries. Map I-1 shows the location of Terra Nova National Park, and, Map I-2 shows the location of the Charlottetown enclave and communities near park boundaries.

Land Use Prior to Park Establishment

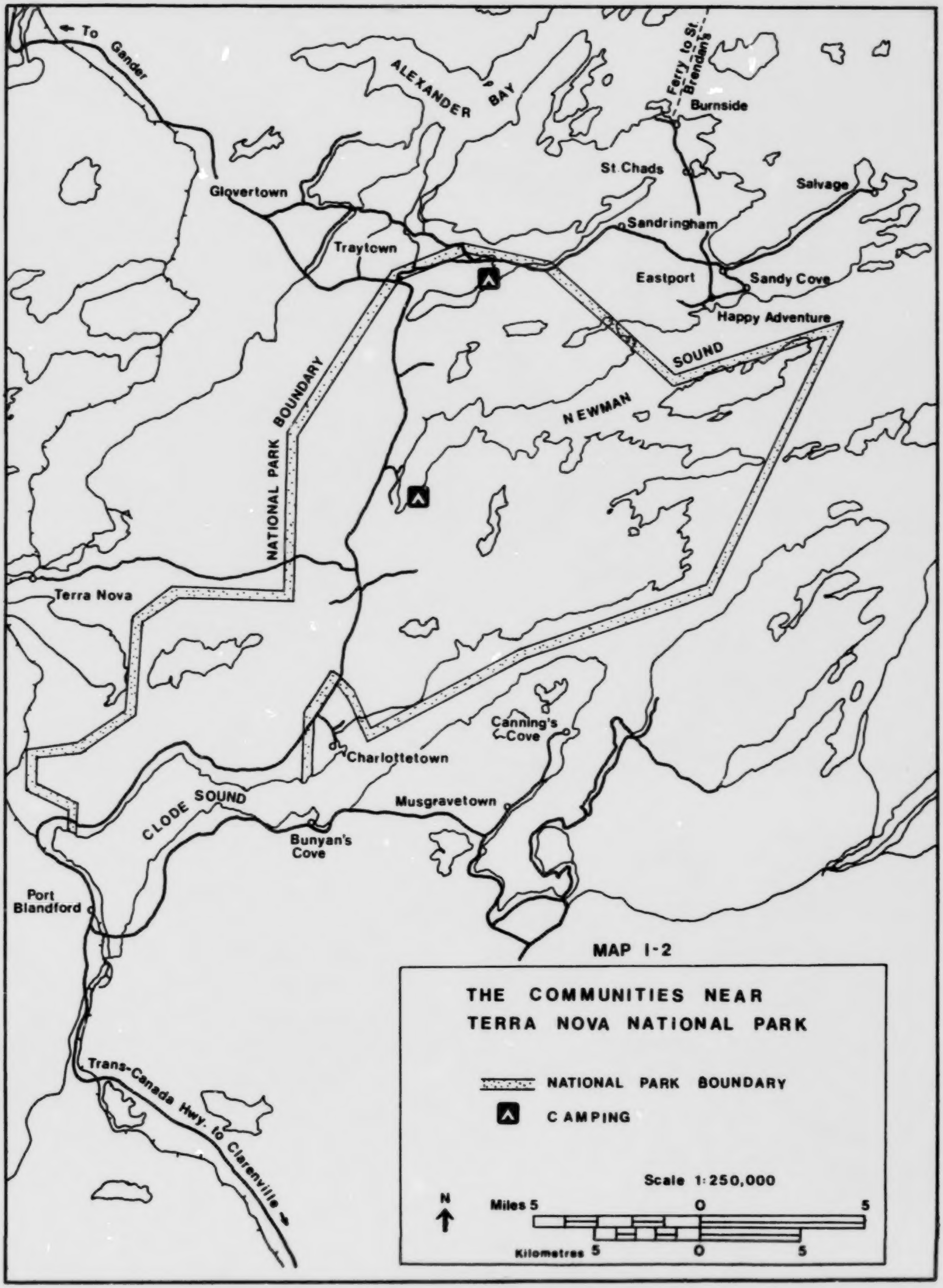
The first evidence of actual habitation within present park boundaries is provided by traces of a few cleared sites and a grave marked 1755 at Bread Cove (Major, 1979). However, areas adjacent to the park, such as beaches situated approximately 20 km. from the western boundary, experienced human occupation between 2950 and 250 B.C. It may therefore be reasonable to assume that some use was made of the present day park area during that time for purposes of hunting, trapping, etc.

During the 1800's, the park area was utilized for hunting, trapping and woods work. An early surveyor, J. B. Jukes (after sailing to Clode Sound in July of 1840), made a comment to the effect that all the best and largest timber had been cut. By the second decade of the 20th century, sawmillers had spread to Clode Sound and Newman Sound. Prior


Trans-Canada Highway
Corner Brook
Gander
Terra Nova National Park
St. John's
Channel-Port aux Basques
50 km.

MAP I-1

MAP OF INSULAR NEWFOUNDLAND SHOWING LOCATION OF TERRA NOVA NATIONAL PARK



MAP I-2

THE COMMUNITIES NEAR TERRA NOVA NATIONAL PARK

← To Gander
ALEXANDER BAY
Ferry to St. Brendan's
Burnside
St. Chads
Salvage
Glovertown
Sandringham
Traytown
Eastport
Sandy Cove
Happy Adventure
SOUND
NEWMAN
NATIONAL PARK BOUNDARY
Terra Nova
Canning's Cove
Charlottetown
CLODE SOUND
Musgravetown
Bunyan's Cove
Port Blandford
Trans-Canada Hwy. to Clarenville →
NATIONAL PARK BOUNDARY
CAMPING
Scale 1:250,000
N
Miles 5
0
5
Kilometres 5
0
5

to this time, the Sounds were mainly areas of winter activity. With the spread of sawmilling, the area experienced year-round occupancy. Coves from Lion's Den and Park Harbour along to Port Blandford, as well as major areas of Newman Sound, witnessed sawmilling at one time or another. At the time of the establishment of the park in 1957, most of the sawmilling operations had ceased. Those that were still in operation were bought out by the park and eventually dismantled.

Establishment of Terra Nova National Park

Proposals and negotiations for a National Park began in the early 1950's and two stumbling blocks quickly appeared: the importance of the forest industry and hydro-electric potential. Provincial officials stressed the value of forest resources to the Provincial economy and the need to conserve for the Province's use, every available area of forest land (Lothian, 1976). Attention was also called to the urgent need of the Province for additional hydro-electric power. Inclusion of the Terra Nova River in the park would not materialize unless the Province retained its right to develop the river's power potential.

Discussions between Federal and Provincial Authorities regarding these two important matters continued until 1957 when the park was officially proclaimed. The forestry-related problem was resolved by an understanding that would allow the cutting of mature and over-mature timber in the park up to the annual rate of regrowth. This timber was to be used in the first instance for park purposes. Any timber over and above the park's requirements would be sold at commercial rates with preference given to a third pulp and paper mill if and when one was established in Newfoundland.

If there was to be any cutting it was to be done according to the best forest practices under the immediate control of park officers who would select and mark trees. No cutting would occur in any area visible from a road, trail, or any watershed. Normal commercial cutting was not to be permitted.

The Order in Council transferring lands to the National Parks Service in 1957 included an agreement with the Province that any land required for a future hydro-electric development in the park would be withdrawn by Newfoundland for such a development. The original park proposal had included a much larger area of land than at present, but after the negotiations and agreements were completed and the park gazetted, its area was reduced to 396.5 square kilometers. As a result, the park failed to include a significant salmon stream and was too small to sustain caribou. A parcel of land of 368.2 ha. was added to the park at its southern extremity in 1979 to provide for construction of a golf course, which was a stipulation contained in the Gros Morne National Park Agreement. These lands, which have not yet been proclaimed in the Canada Gazette, add the significant salmon river to the park.

Natural Resource Management Objectives of Terra Nova National Park

The following objectives are intended to provide broad principles for all planning, management and development throughout the park:

1. The detrimental effects of park development, visitor activities and operations upon park resources and processes will be minimized.

2. Future management of park resources will provide for continued preservation of significant, representative and rare resources and processes.

3. The natural character of Terra Nova National Park will be maintained and natural processes allowed to evolve with a minimum of human interference.

4. While recognizing the special needs of rare or otherwise significant species and communities, the natural vegetation mosaic of the park and resulting wildlife habitats will in general be protected and allowed to follow normal successional and evolutionary directions. Manipulation of naturally occurring processes, such as fire, insects and diseases may take place only after monitoring has shown that one of the following conditions exist:

    i) there may be serious adverse effects on neighbouring lands;
    ii) public health or safety is threatened;
    iii) major park facilities are threatened;
    iv) natural processes have been altered by man and manipulation is required to restore the natural balance;
    v) a major natural control is absent from the park;
    vi) the continued existence of a plant or animal species, or a biotic community, which is rare or endangered or which is critical to representation of the natural region is threatened;
    vii) the population of an animal species or stage of plant succession which has been prescribed in the objectives for a park, cannot be maintained by natural forces.

5. Protection of rare species of flora and fauna will receive high priority. Active species and/or habitat management as well as passive or protective measures will be undertaken if necessary. Priority of species to be investigated for management needs will be determined on the basis of: level of rarity (national, provincial, regional or park), level of disturbance or deleterious changes jeopardizing the species, and the cost of required management practices. Where active resource management is necessary, techniques will duplicate natural processes as closely as possible.

6. All developments and management activities occurring within the park, including those proposed by agencies other than Parks Canada, will be subject to the Federal Environmental Assessment and Review Process (EARP) which ensures that environmental implications are fully considered in decision making.

7. To ensure positive social, economic and physical impacts, resource management planning will be undertaken in cooperation with adjacent provincial and private land use agencies.

Studies in floral management will be undertaken to determine which species or communities require management and which methods are most appropriate and feasible. Generally, passive management will be preferred to active management. Non-native plant species will not be introduced. Only native plant species will be used for landscaping or rehabilitation. If necessary, operational practices will be modified so that the creation of desirable habitats for non-native species is reduced. The effects of development, use and resource management practices on flora will be monitored.

Studies in the management of fauna will continue to:
- identify additional rare and endangered species, and their habitats;
- determine which species of fauna and which habitats of such species require management;
- determine the most appropriate and feasible methods of management for the shore.

The result of such work will be the development of appropriate management guidelines. Generally, passive management will be preferred and the studies will concentrate on establishing the following:
- the status of each particular species;
- population levels and trends;
- existing habitat conditions and future requirements; and
- ecological importance.

Species eliminated by natural processes will not be reintroduced. Consideration will be given to the reintroduction of species eliminated directly as a result of human interference only if suitable habitat remains, and no detrimental effects on existing resources are anticipated.

A fish management plan will be established to satisfy the need of both protecting fish populations and habitats and also providing an adequate supply of the various species for sport fishing. The plan will:
- identify lakes where fishing will be allowed;
- establish limits to ensure the maintenance of viable fish populations.

The effects of development, use and resource management practices on faunal populations will be monitored. Resource management plans and practices will be revised and modified when necessary.

Parks Canada will cooperate with adjacent land-use agencies in the protection of fauna which cross the land and water boundaries of Terra Nova National Park.

Special natural resource management programs which relate to the protection of representative, unique, rare, endangered or fragile natural resources and process will be established:

1. A resource management plan containing measures for the protection of the reintroduced Pine Marten population and its critical habitats in the park will be prepared.

2. Wings and Bluehill Brooks contain relic, but viable populations of Atlantic Salmon; the stocks in these streams should be managed to ensure that they are perpetuated.

3. Bluehill Pond supports a population of Arctic char, a rare fish at this latitude, that should be protected and managed carefully.

4. Seabird colonies, particularly common terns (several), and Eiders (one) require careful monitoring and protection.

5. There are five active eeries of Bald Eagles in the park on coastal locations, every consideration for the protection of these sites is important.

6. While not currently within the legal boundaries of the park, beds of scallops, and shellfish of limited

population size, or low productivity require consideration, particularly important in view of the possible addition of a marine component to Terra Nova National Park.

7. Wildfire has been an important mechanism in the past in respect to the present vegetational composition of much of the park. In view of this, it is recognized that this subject requires further study.

8. The effect of Spruce Budworm, as well as other defoliating insects, on the forests of Terra Nova National Park has been marked. As with wildfire, it is an important aspect to be studied.

9. Beaver are an important member of the park fauna, the development of facilities in the future should be planned so as not to negatively interact with this species.

10. Wildlife, (particularly moose), has taken a significant drop in resident populations because of mortality due to motor vehicles. An educational program is to be put in place and it may ameliorate this problem somewhat.

11. A number of environmental concerns are important in the park;
    a) rehabilitation of disturbed sites;
    b) pollution prevention in park waters;
    c) minimizing impact of maintenance and planned new construction.

Cultural Resource Protection and Management in Terra Nova National Park

Parks Canada has a responsibility to protect significant archaeological resources within the park and the other cultural resources which are of particular significance and/or interest to the public. The park's cultural aspects offer considerable potential for interpretation. It is important that visitors have an opportunity to appreciate the influence of man so they can better understand the existing landscape and ecosystem of the park.

The most important cultural resources in Terra Nova National Park that are in need of protection are the archaeological sites from pre-European contact and the significant pieces of evidence of European land uses and settlement. Examples of an early occupation or occupations of one or more groups of native peoples terminating with the Beothuks a few hundred years ago is evident on the southeastern coast of the park. It is of note that the park is in a region rich in archaic remains. Post contact influence has been important too. It began with hunting and trapping, which continued, and was later joined by lumbering, shipbuilding and settlement associated with fisheries.

The following guidelines will allow for the protection of important archaeological and cultural resources while allowing visitors the opportunity to understand and appreciate the history of Terra Nova National Park:

1. An inventory of archaeological resources will be prepared describing known archaeological resources, their location, nature, importance and manner in which they should be protected.

2. Where possible, trail or other visitor facilities will be established an adequate distance away from archaeological resources.

3. So that significant archaeological resources are protected, they will not be purposely exposed, and their exact location will not be conveyed to the park visitor until adequate protection, interpretation and monitoring guidelines have been established.

4. Selected archaeological resources will be monitored on a regular basis to ensure they are not deteriorating or becoming exposed.

5. Any archaeological resources undergoing damage through visitor activities will be closed off to the public.

6. Site design guidelines will be established which will ensure that full consideration is given to archaeological resources in facility planning and in subsequent zoning.

7. Cultural resources in the park will be protected when:
   - such resources have been identified as having particular significance to the theme "A Land Facing Seaward"; and
   - when their protection does not impair or detract from important natural resources.

8. Investigations will continue to identify cultural resources remaining in the park which require protection and which have interpretive potential.

9. To ensure that evidence of 19th and 20th century post contact activities are protected, and preserved, based on their values and relevance.

10. To encourage the continuance of local and traditional skills as much as possible.

11. To recognize the importance of the marine connotation when and if the park is so designated.

Methodology

The preparation of the Resource Description and Evaluation for Terra Nova National Park was organized as follows:

1. Formation of a Natural Resource Management Planning team.
2. Literature review and selection of basic reference material.
3. Description and analysis of component natural resources.
4. Evaluation of natural resource opportunities and limitations.
5. Review by appropriate authorities and final editing.

The Natural Resource Management Planning team consisted initially of four Park Wardens and the Resource Management Advisor. Shortly after the project got under way, the Resource Advisor relocated to another park and his replacement assumed leadership for the project's completion. The team received assistance from personnel of other park sub-activities as well as from natural resource conservation personnel at both Regional Office and Headquarters.

The literature review and selection of basic reference material utilized such sources as the park files and library, Warden Station files, Atlantic Regional Office Resource Conservation and general libraries, Atlantic Regional Office map collection, and the Canadian Geographic Information System. Major items of reference material included "A Biophysical Classification of Terra Nova National Park" (1977) by Gauthier, Poulin, Theriault, Ltd.; "Marine Intertidal Ecology Study" (1979) by Hunter and Associates; "Avifauna Study, Terra Nova National Park" (1980) by R. Burrows; "A Mammal Study of Terra Nova National Park" (1980) Interim Report by B. Roscoe; Canadian Wildlife Service Limnological Reports (1968-72) by J. Kerekes; "Terra Nova National Park: Human History Study" (1979) by Kevin Major; "Rocks and Scenery of Terra Nova National Park" (1966) by David M. Baird; and "Canadian Climate Normals 1951-80 Temperature and Precipitation Atlantic Provinces" published by the Atmospheric Environmental Service.

An outline for the Resource Description and Evaluation was prepared and topics were assigned to various team members. The following natural resource headings were chosen:

Climate
Ecological Land Classification
Hydrology
Geology/Geomorphology
Soils
Flora
Mammals
Avifauna
Amphibians
Freshwater and Anadromous Fish
Terrestrial and Non-Marine Invertebrates
Intertidal Marine Invertebrates and Fish
Archaeology and Human History
Past and Present Land Uses

A map of the park, suitable for use as a descriptive base for these resource topics, was prepared. Draft presentations for the subject areas were then written. Regular meetings of the team were held to resolve any problems and report on progress. The required maps, tables, charts and figures accompanying the descriptions were prepared for final drafting. An evaluation of natural resource opportunities and limitations was developed by the park's Resource Management Advisor and other authors as noted on the acknowledgement page. An "Introduction" section was prepared with appropriate subject matter from the deleted section "Past and Present Land Uses" being included. The individual resource component descriptions were submitted to appropriate subject authorities for review, and, final editing of the manuscript was completed by the Natural Resource Conservation Section of Atlantic Regional Office. Arrangements for printing of the document were completed by the park's Resource Management Advisor.

Section II

CLIMATE

The sea has a dominating influence on the climate of Insular Newfoundland. Practically encircled by the cold waters of the Labrador Current, the Island is generally considered to have a marine climate although western and central portions exhibit continental features. While not characterized by great extremes of wetness or heat, the climate does exhibit a fairly wide range of conditions which are the result of cyclonic storms that continually affect the Island as they leave the continent by way of the Gulf of St. Lawrence. The mean annual precipitation varies from less than 1000 mm in northern areas to more than 1500 on the Avalon Peninsula and south coast. Figure II-1 indicates the mean annual precipitation for Insular Newfoundland, while Figure II-2 provides a picture of the Island's mean annual snowfall.

Mean July temperatures range from 12°C to 17°C, and mean January temperatures from -2°C to -9°C. Frequent high wind velocities are a notable climatic feature with maximum hourly mean velocities at exposed coastal sites being amongst the highest in Canada (Bonavista 32 m/sec, Burgeo 36 m/sec and Cape Race 37 m/sec).

Terra Nova National Park Climate

Terra Nova National Park has a marine climate characterized by brief, cool summers and moderate winters. Climatic zones of Newfoundland by Banfield locates the park in the East Coast and Hinterlands Zone (Map II-1) which is described as

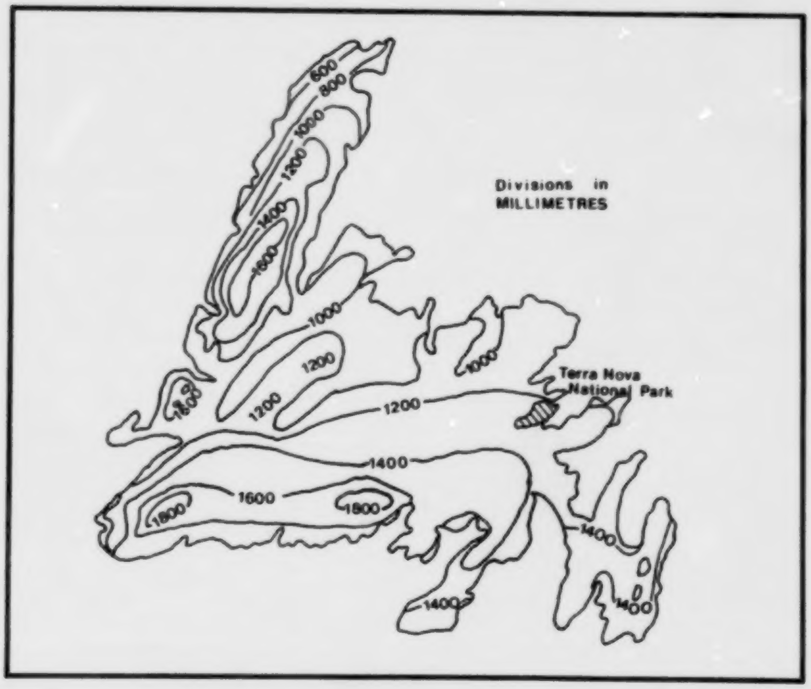

600
800
1000
1200
1400
1600
Divisions in MILLIMETRES
1000
1200
1200
1800
1000
Terra Nova National Park
1200
1400
1600
1800
1800
1400
1400
1400

FIGURE II-1 Mean Annual Precipitation (Peach, 1975).

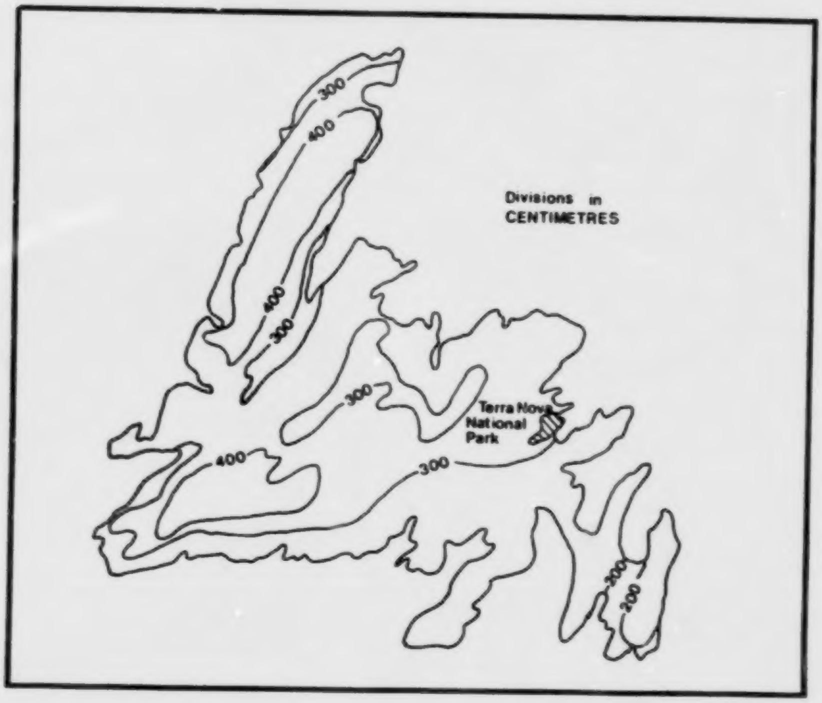
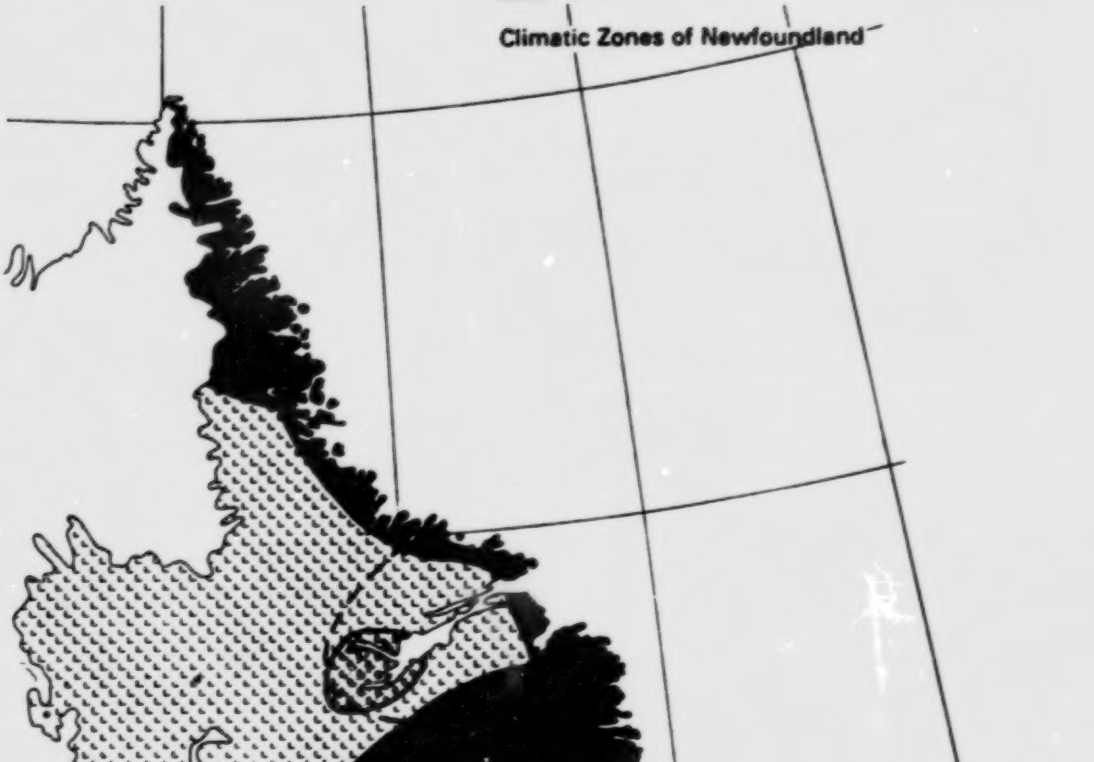

300
400
Divisions in CENTIMETRES
400
300
300
Terra Nova National Park
400
300
200
200

FIGURE II-2 Mean Annual Snowfall (Peach, 1975)

MAP II-1

Climatic Zones of Newfoundland



- - - - - - Southern limit of discontinuous permafrost (Brown, 1968) having occasionally heavy precipitation with north-easterly or northerly airflow; winters cold with 50-70 per cent of precipitation falling as snow; snow cover normally continuous, at least throughout February; late springs with ice persisting until mid-May; summers generally warm and fairly sunny.

Within the park area, aspect, elevation, exposure, slope and other factors combine to create zones of differing temperatures and rates of precipitation. Precipitation increases with elevation so that the central line of hills in the park receives more rain and snow than other areas. Temperatures are higher at lower elevations; thus the low coastal areas receive much of their mid-winter precipitation as rain. In warmer months, thermal inversions may cause frost in the hollows and belts of warm air on the hillsides. Southwest slopes are warmest and northeast slopes are the coldest. Areas next to the coast are most affected by the sea temperatures and experience milder winters and cooler summers than the higher and more inland western regions of the park.

Temperature and precipitation have been recorded at park headquarters since 1962. February is the coldest month with a mean daily temperature of -5.8°C. July is the warmest month registering the high mean daily temperature of 16.4°C. August is only slightly cooler (16.0°C) and the higher mean daily minimum temperature reflects the increased water temperature of Bonavista Bay (July 5 - 10°C, August 10 - 15°C). Table II-1 provides the park headquarters monthly mean daily maximum, mean daily minimum and mean daily temperatures during the period 1962-1980.

Table II-1

Terra Nova National Park Headquarters Monthly Mean Daily Maximum, Mean Daily Minimum and Mean Daily Temperatures During the Period 1962-1980.*

Month	Temperature Mean Daily Maximum	Mean Daily Minimum	Mean Daily Temperature
January	-1.6	-8.9	-5.3
February	-2.1	-9.5	-5.8
March	1.1	-6.4	-2.7
April	5.0	-1.7	1.7
May	11.3	2.0	6.7
June	17.0	6.8	11.9
July	21.5	11.2	16.4
August	20.5	11.5	16.0
September	16.4	8.0	12.2
October	10.3	3.1	6.7
November	5.7	-0.4	2.7
December	0.3	-6.2	-3.0
Annual	8.8	0.8	4.8

* Source: Canadian Climate Normals, 1951-1980, Temperature and Precipitation, Atlantic Provinces. Atmospheric Environment Services, Downswiew, Ontario.

Total annual precipitation at park headquarters between 1962 and 1980 averaged 1130.8 mm, 75 per cent of which fell as rain. Table II-2 indicates that July is the driest month with 71.5 mm of rain, while November is the wettest with 112.8 mm of combined rain and snow. Freezing rain and drizzle are also common in the park area. February is the snowiest month with 59.7 cm falling on average, but the months of December through March have only slightly less snow. The "glitter storm" is a relatively common phenomenon in the park, being caused by the arrival of warm, moist air at a time when the ground and the air just above it are below freezing. The water precipitates from the warm air, freezing upon contact with the ground and objects above it. These storms and the frequency of freezing rain and drizzle create many layers of crust in the snow during most winters at Terra Nova National Park.

Winds affecting the park area arrive mainly from the west, with a strong northwest vector in winter and a greater southwest component in summer. Average wind speeds for eastern Newfoundland are high (22 km/h at Gander, 26 km/h at Bonavista) (Peach 1975). In summer, west winds bring mild weather because they have crossed the warm continental mass. On the other hand, a northeast wind from the North Atlantic is accompanied by low temperatures and overcast, often with drizzle or fog. In winter, south winds can produce a mild spell, while northwest winds from the Arctic ice cause temperatures to drop quickly. Three of the coldest months, January, February and March, are also the windiest (Peach 1975). The result is a high wind-chill factor for considerable periods especially in the high, exposed areas of the park. Even summer wind-chill can cause a sunny day in July to be very cool on the coast. Calm periods are recorded

Table II-2

Terra Nova National Park Headquarters Monthly Precipitation as Rain, Snow, and Total During the Period 1962-1980.*

Month	Precipitation		
	Total	Rain	Snow
January	103.4	50.7	56.5
February	105.4	42.1	59.7
March	92.1	40.4	48.3
April	81.8	54.6	24.1
May	83.0	79.2	4.8
June	75.4	74.5	0.6
July	71.5	71.5	0.0
August	105.1	105.1	0.0
September	88.8	88.9	0.0
October	105.4	102.0	4.7
November	112.8	95.1	17.0
December	106.1	49.8	54.2
Annual	1130.8	854.8	269.9

* Source: Canadian Climate Normals, 1951-1980, Temperature and Precipitation, Atlantic Provinces, Atmospheric Environment Service, Downsview, Ontario.

only 2 to 3 per cent of the time with most frequent calms in the spring and summer.

The length of day varies from 16.5 hours in late June to 8 hours in late December. Most of the sunlight occurs in July, a time when the days are longest. Maximum overcast skies are most common in September with 23 per cent frequency. Minimum clear sky conditions are the rule in May and June as the amount of cloud decreases from winter to summer, but the variation in the average throughout the year is small.

Thunder is an uncommon occurrence, with a total of 6.9 days with thunder having been recorded in Gander in one year. Thunderstorms are even less frequent along the coast. Table II-3 gives hours of bright sunshine, duration of daylight, cloud cover frequency (%) and number of days with thunder during the period June through September.

Fog is common throughout the year on the coast and inland. Fog in the Terra Nova National Park region is most common in April, May and June. In Summer, fog rarely extends far inland, and, when the wind is blowing offshore, there is often a clear belt between the coast and the fog.

Suitable Days for Recreational Activities

A report by Peach (1975) evaluating climate quality used the concept of "suitable days", a suitable day being one in which there were at least five hourly reports (not necessarily consecutive) of "suitable weather" between 10:00 a.m. and 6:00 p.m. to assess weather suitability for recreational activity. Up to eighteen years of weather records were searched to discover the number of days that could be designated "suitable" for the various tourist and outdoor

Table II-3

Monthly Mean Values of Hours of Bright Sunshine, Duration of Daylight Hours, Cloud Cover Frequency and Number of Days with Thunder.*

	June	July	August	September
Number of Hours with Bright Sunshine	160.0	200.0	178.0	143.0
Duration of Daylight Hours	16.5	16.5	14.0	13.0
Cloud Cover Frequency (%)				
80-100%	69.0	60.0	62.0	59.0
30-70%	17.0	22.0	20.0	18.0
0-20%	14.0	18.0	18.0	23.0
Number of Days with Thunder	1.1	2.4	2.2	0.3

* Hunter and Tress, 1972

recreation activities, except yachting, according to the criteria listed in Table II-4. Calculations were carried out for each ten-day period in the year, and the number of suitable days in each ten-day period was expressed as a percentage. These percentages are a convenience in relating climate to the enjoyment of outdoors.

TABLE II-4
Climatic Criteria For Designation Of A Suitable Day By Activity Or Activity Grouping

CLIMATIC CRITERIA FOR DESIGNATION OF SUITABLE DAYS

Activity	Humidex	Temperature Degress C F	Visibility km mi	Cloud Amt.	Wind km/h mi/h	Snow Cover	Precipitation
YEAR-ROUND							
Landscape Touring	-12 to 89	-24 to 24°C -12 to 75°F	greater than 5 km 3 mi	N/A	less than 40 km/h 25 mi/h	N/A	Nil
WINTER							
Skiing	greater than 6	greater than -14°C 6°F	greater than 1 km ½ mi	N/A	less than 24 km/h 15 mi/h	5 cm, 2 in. or more	Nil or light snow or flurries
Snowmobiling	greater than -6	greater than -21°C - 6°F	greater than 1 km ½ mi	N/A	less than 24 km/h 15 mi/h	5 cm, 2 in. or more	Nil or light snow or flurries
SUMMER							
Vigorous activity	55 to 89 inclusive	12 to 24°C 54 to 75°F inclusive	greater than 3 km 2 mi	less than 8/10	less than 32km/h 20 mi/h	N/A	Nil
Beaching activity	greater than 64	greater than 16°C 60°F	greater than 1½ km 1 mi	less than 8/10	less than 24 km/h 15 mi/h	N/A	Nil
Yachting		-24 to 24°C -12 to 75°F	greater than 8 km 5 mi	N/A	less than 40 km/h 25 mi/h	N/A	Nil or light rain

The nearest weather stations in this study were Gander, to the northwest of the park, and Bonavista to the east. Figures II-3 and II-4 indicate the annual variation of suitable days for landscape touring, snowmobile/skiing, vigorous activity and beaching activity at these two locations adjacent to the park.

Microclimatic Variations

The local direction of surficial airflow is determined by topography and ecosystem characteristics. In the park, summer morning fogs normally recede in a northeasterly direction, as prevailing wind forces increase. These fogs occur in all outer coastal regions. Fog as high as the 45 to 60 meter contour is a relatively common occurrence in Newman and Clode Sounds. The fog is trapped under a thermal inversion (Hunter and Tress, 1972).

In summer, valley sites, in comparison to hill tops are coldest and moistest by night, but warmest and driest during the day. Valley sites are therefore more exposed to frost danger at night, the air is more still and hence, may be hot and dust laden during the day and fogs may be more frequent.

Temperatures decrease with height. Peaks have the least diurnal variation; the night temperature is exceeded by that of the valley and they are driest by night and most humid during the warm part of the day.

Slope climate may have significant implications. At night, during the summer, west slopes are warmer than east slopes. During the day, southwest slopes are warmest and northeast slopes coolest. Temperatures on northwest and southeast slopes tend to be more moderate with values lying between those on the aforementioned slopes (Hunter and Tress, 1972).

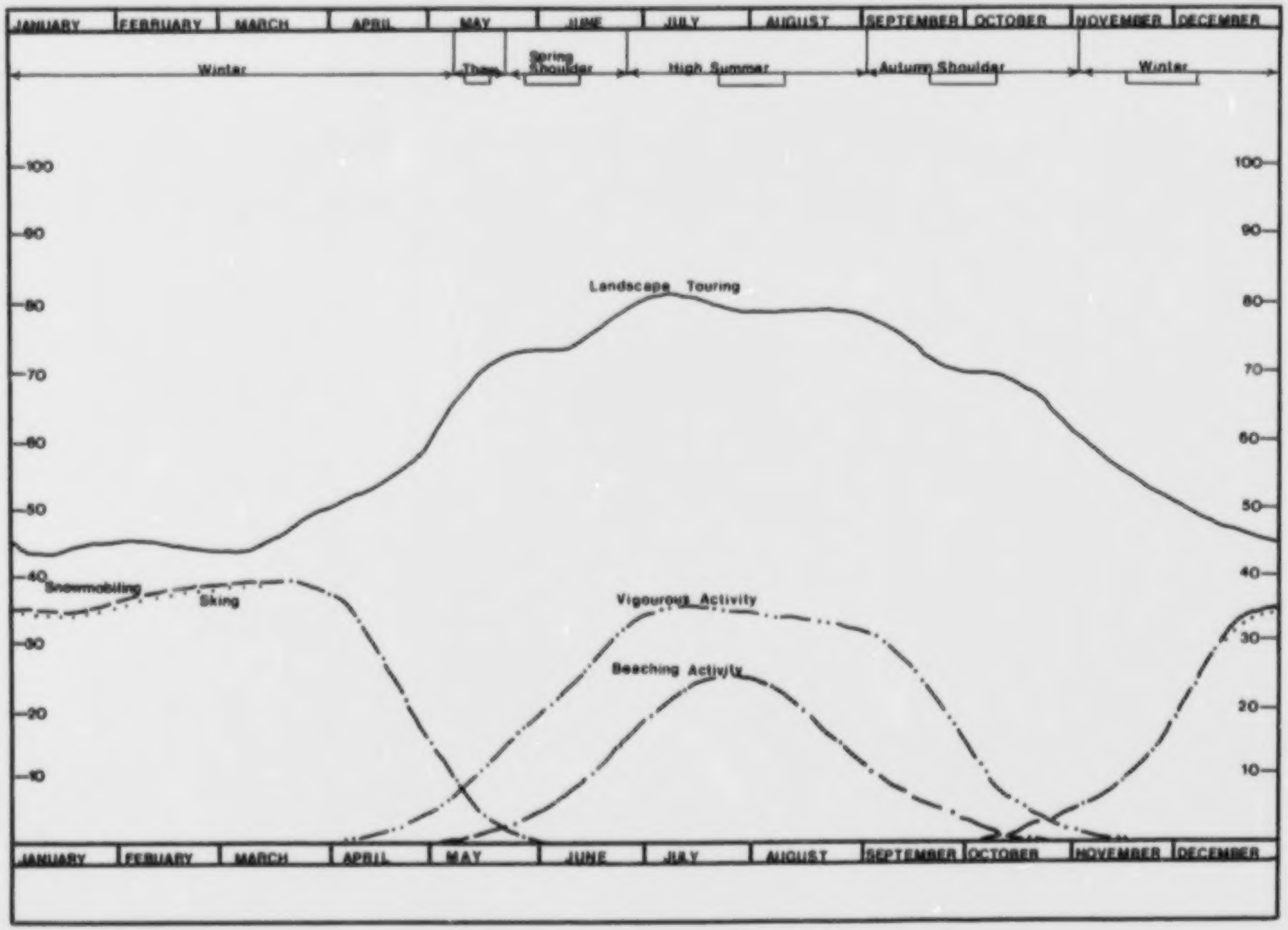


FIGURE II-3

Annual Variation of Suitable Days For Landscape Touring, Snowmobile/Skiing, Vigorous Activity, and Beaching Activity at Gander, Newfoundland.

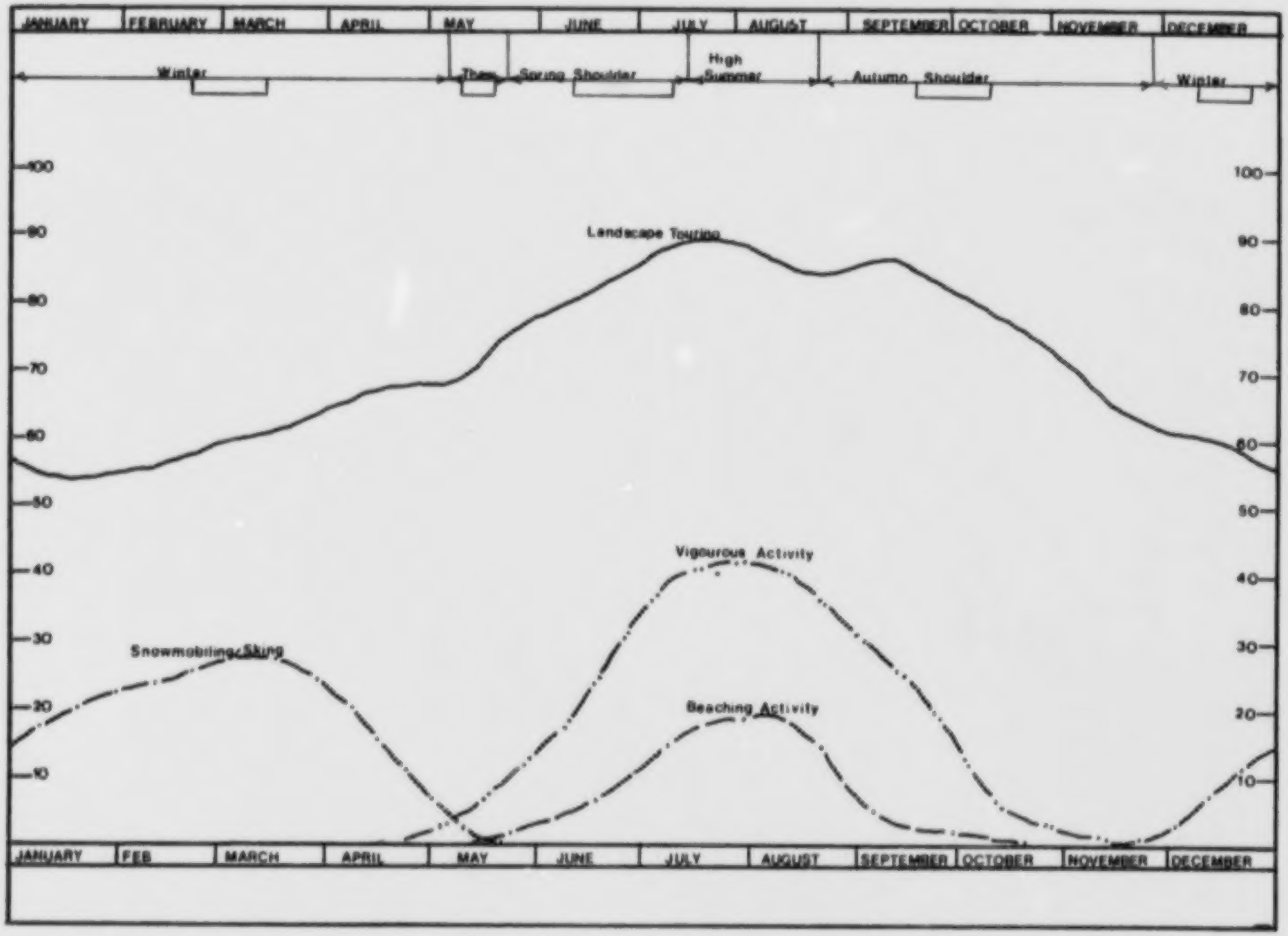


FIGURE II-4

Annual Variation of Suitable Days For Landscape Touring, Snowmobile/Skiing, Vigorous Activity, and Beaching Activity at Bonavista, Newfoundland.

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Section III

ECOLOGICAL LAND CLASSIFICATION

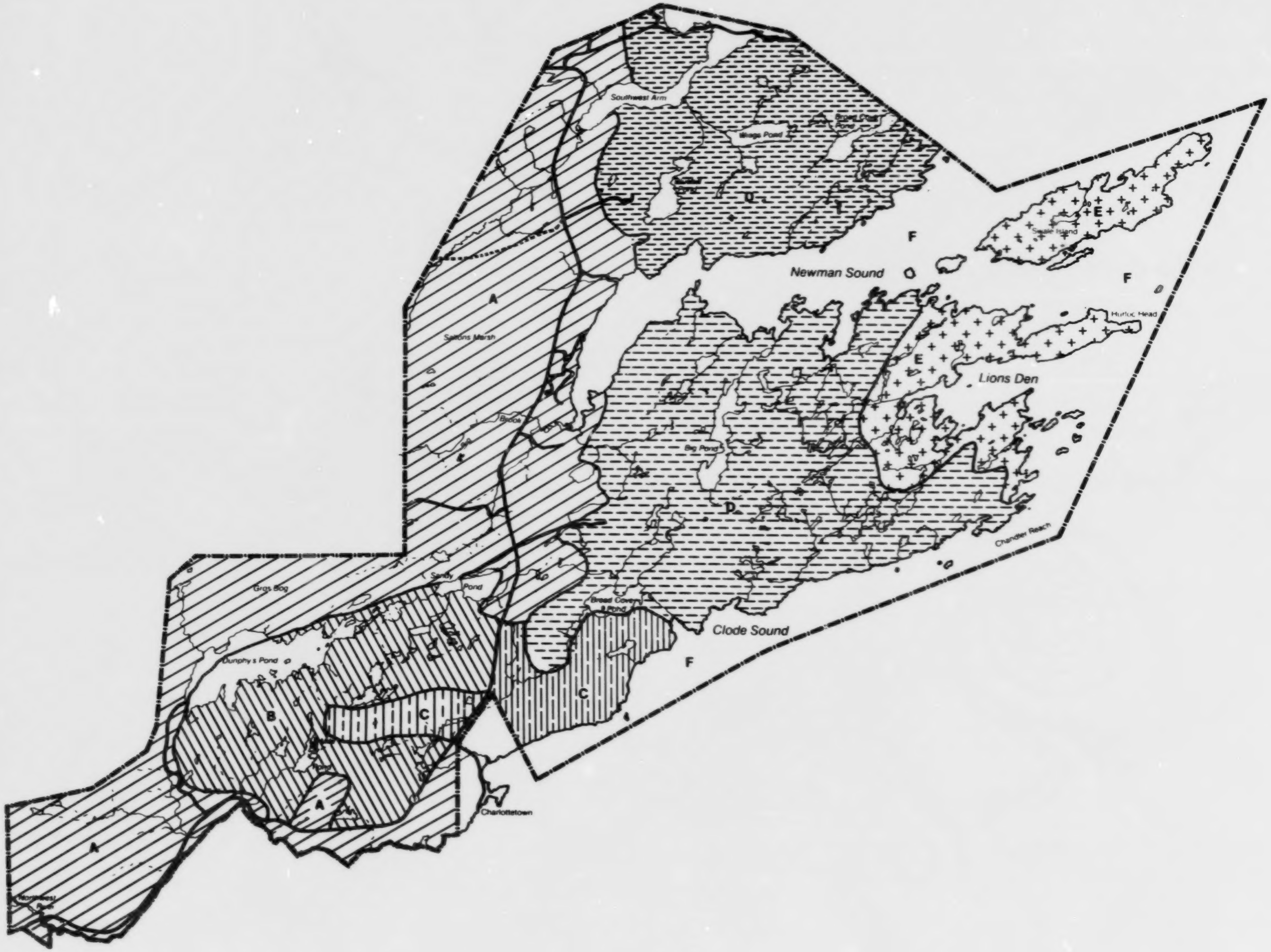
Terra Nova National Park has been sub-divided into ecological units at the five levels of perception provided in the Ecological Land Classification framework. These are ecoregion, ecodistrict, ecosection, ecosite, and ecoelement. This division was accomplished using a classification and description of surficial deposits, soils, vegetation, water bodies, shoreline morphology and dynamism. The park embraces one ecoregion, five land ecodistricts and one marine ecodistrict, fifty-six ecosections, thirty-nine ecosites and one hundred and forty-one shoreline ecoelements.

Ecological Land Classification Levels

Ecoregions are characterized by distinctive ecological responses to climate as expressed by the development of vegetation, soils, water, fauna, etc. Terra Nova National Park is situated in the northern extent of the Avalon section of the Boreal forest region. It is characterized by a climax vegetation of balsam fir - feather moss that colonizes mesic upland sites and by the high rate of accumulation of organic matter at the surface of the soil, under the influence of the cool, moist climate.

Ecodistricts are characterized by a distinctive pattern of relief, geology, geomorphology, vegetation, soils, water and fauna. Within Terra Nova National Park, five land ecodistricts and one marine ecodistrict have been delineated and are shown on Map III-1.

Terra Nova National Park


Southwest Arm
Mings Pond
Broad Cove Pond
D
F
Newman Sound
E
Swale Island
F
Hurloc Head
E
Lions Den
A
Saltons Marsh
Brook
Big Pond
D
Chandler Reach
Sandy Pond
Gros Bog
Bread Cove Pond
Clode Sound
F
Dunphy's Pond
B
C
C
A
A
Charlottetown
Northwest Pond

MAP III-1

Ecodistricts of Terra Nova National Park

A - GROSS BOG

B - DUNPHY'S POND

C - BREAD COVE

D - BIG POND

E - SWALE ISLAND

F - THE SOUNDS

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

Of the 5 ecodistricts, "A" and "B" are the two largest, containing 21 and 20 ecosections respectively. Ecodistrict "A" contains both the largest and smallest ecosection at 2 614 ha and 93 ha. The average ecosection size is 664 ha.

Ecodistricts of Terra Nova National Park

The following description of the ecodistricts of Terra Nova National Park has been excerpted from the "Biophysical Classification - Terra Nova National Park", by Gauthier, Poulin, Theriault, Ltd. (1977).

Ecodistrict A: This unit is characterized by a series of drumlinoid hills interspread by narrow valleys with a strong southwest to northeast orientation. The smoothness of the relief and the thickness of the surficial deposits are also significant elements of this district which occupies the western part of the park. It extends to the series of hills from the Louil Hills to Ochre Pit Hill. Ecodistrict A has been sub-divided into 21 ecosections and 384 ecosites. It has an area of 13 994 ha.

Ecodistrict B: Situated between the Trans Canada Highway and the natural boundary formed by Dunphy's Pond, Sandy Pond and Beaver Pond, Ecodistrict B consists of an upland plateau characterized by thin surficial deposits and a variable local relief due to the influence of the bedrock. This landscape contrasts sharply with that of the thick drumlinoid deposits of Ecodistricts A and C. Six ecosections and 108 ecosites were integrated within this district of 4 993 ha.

Ecodistrict C: A smooth, flattened crest running in a southwest to northeast direction forms the core of this unit. Thick drumlinoid deposits are at the origin of this uniform landscape. This district runs from Long Waters Pond to the park boundary along the Trans Canada Highway and then south of Bread Cove Brook to Bread Cove. It has an area of 1 930 ha and includes 3 ecosections and 56 ecosites.

Ecodistrict D: A bedrock controlled topography capped by thin till deposits constitutes the dominant feature of the landscape. Physionomically, it is situated halfway between the rounded contours and drumlin deposits of the western part of the park (Districts A and C) and the partly denuded bedrock landscapes of District E. The largest in the park, this unit extends from the series of hills that mark its boundary with District A, east to the sea except for a narrow fringe around the Lion's Den. It comprises 20 ecosections further sub-divided into 384 ecosites and has an area of 14 923 ha.

Ecodistrict E: A spectacular relief, controlled exclusively by the monoclinal stratification of the bedrock, the absence of a continuous forest cover, and the presence of a marine environment are its main characteristics. It extends over Swale Island and the land area around the Lion's Den from Little Cold East to Shag Point. This district encompasses 3 813 ha, comprised of 6 ecosections and 87 ecosites.

A summary of the ecodistrict components for Terra Nova National Park by District is presented in Table III-1.

Ecosections possess a recurring pattern of landforms, soils and vegetation. Within Terra Nova National Park, fifty-six ecosections have been mapped along with thirty shoreline sections. Delineation of the ecosections was based on topography, surficial deposits, vegetation cover and land/sea interface.

Table III-1
Classification of Terra Nova National Park by Ecodistrict Showing Number of Ecosections, Land Area, Pond Area, and Total Area of Each

Ecodistrict	No. of Ecosections	Land Area	Pond Area	Total
A	21	13 700	294	13 994
B	6	4 171	822	4 993
C	3	1 802	128	1 930
D	20	13 839	1 084	14 923
E	6	3 701	112	3 813
TOTALS	56	37 214	2 439	39 653
PERCENT		93.85	6.15	100

The classification of an area at the ecosite level involves a relatively detailed classification of the soils and a knowledge of the plant successions on these sites. The physical portion of the landscape must be linked with the plant communities and successions to describe and comprehend the ecosystem perceived at the level of the ecosite. Table III-2 shows the characteristics of the thirty-nine ecosites that have been recognized in the park.

Shoreline Ecosections of Terra Nova National Park

There are 30 shoreline ecosections on the coast of the park. Each ecosection is broken down in ecoelements, there being

Meaning of Symbols Used in Table III-2

Surficial Deposits

R	Bedrock
Wf	Weathering deposits
Mg	Ground moraine
Md	Drumlin
Ml	Lateral moraine
Mh	Hummocky moraine
Mr	Reworked till
Ge	Esker
Go	Outwash deposits
Gd	Delta
Bsg	Marine sediments
Lsg	Lacustrine sediments
Fp	Fluvial plain
Fl	Alluvia levee
Fd	Raised delta
Et	Estuarine sediments
Ss	Scree slope
Ob	Bog
Ofy	Deep fen
Ofe	Shallow fen
Ofb	Very shallow fen
Om	Marsh
O	Undifferentiated organic deposits
Mg(R)	Shallow ground moraine
Mg-R	Very shallow ground moraine
R-Mg	Bedrock with pockets of ground moraine

Drainage Class

1	Rapid
2	Good
3	Moderate
4	Imperfect
5	Poor
6	Very Poor
*	Indicates seepage

Climax Vegetation

Bak	Kalmia barren
Bar	Rock barren
Bom	Ombrotrophic Bog Complex
Boo	Mesotrophic Bog Complex
Ca-bF	Carex-balsam fir
Cl-bS	Cladonia-black spruce
Cl-K-bS	Cladonia-Kalmia-black Spruce
Dry-Ly-bF	Dryopteris-Lycopodium balsam fir
Fed	Draw fen
Fes	Seepage fen
Hyl-bF	Hylocomium-balsam fir
K-bS	Kalmia-black spruce
Mab	Beaver dam marsh
Mae	Estuarine marsh
Maf	Fluvial marsh
Pl-bF	Pleurozium-balsam fir
Ru-bF	Rubus-balsam fir
Sp-K-bS	Sphagnum-Kalmia-black spruce
Swa	Alluvial swamp
Swp	Peat margin swamp

[1] Source: Biophysical Classification: Terra Nova National

Table III-2

Characteristics of Thirty-Nine Ecosites Found in Terra Nova National Park

Land Form And Position	Surficial Deposit	Drainage Class	Soil Series	Climax Vegetation
Upper slope, steep uniform slope	M, Mg, Ml	2	1	Pl-bF
Moderate slope	M, Mg, Ml Mr	3, 3*	2	Hyl-bF
Base of long or steep slope, seepage, rich soil	M, Mg, Ml Mr	3*	3	Dry-Ly-bF
Gentle or lower slope	M, Mg, Ml, Mr	4,4*	4	Hyl-bF
Lower slope or foot of steep slope, seepage, rich soil	M, Mg,Ml, Mr	4*	5	Ru-bF
Flat, bog border or island in bog or fen	M, Mg, Md, Mr	5	6	Sp-K-bS
Lower slope, foot of steep slope, narrow valley, rich seepage soil	M, Mg, Md	5*	7	Ca-bF
Local depression, running water, near peat margin	M, Mg, Md	5*	8	Swp
Convex crest, knob	Md, Mh	1-2	9	Cl-K-bS
Gentle to moderate slope	Md, Mh	2, 3, 3*	10	Hyl-bF
Gentle to moderate slope	Md, Mh	4, 4*	11	Hyl-bF
Crest or flat surface	Ge, Go, Gd, Fd	1-2	12	Cl-bS
Flat surface, steep slope	Ge, Go, Gd	2-3	13	Cl-K-bS

Table III-2 (Contin.)

Land Form And Position	Surficial Deposit	Drainage Class	Soil Series	Climax Vegetation
Moderate slope	Go, Gd	3-4	14	Hyl-bF
Gentle slope flat area	Bsg, Lsg	2	15	K-bS
Gentle slope flat area	Bsg, Lsg	3-4	16	Hyl-bF
Gentle slope flat area	Bsg, Lsg	5	17	Sp-K-bS
Floodplain	Fp	5, 5*	18	Swa
Scree slopes	Ss	1* to 4*	19	Hyl-bF
Variable	Mg(R),Md(R) Mg-R, R(Wf)	2	20	Pl-bF
Variable	Mg(R),Md(R) Mg-R, R(Wf)	3	21	Hyl-bF
Variable	Mg(R),Md(R) Mg-R, R(Wf)	4	22	Hyl-bF
Variable	Mg(R),Md(R) R(Wf)	5	23	Sp-K-bS
Exposed summits	Mg-R,R(Mg), R(Wf)	1	24	Bar
Rolling terrain, irregular	Mg-R,R(Mg), R(Wf)	1-2	25	Cl-K-bS
Rolling terrain, irregular	Mg-R,R(Mg), R(Wf)	1 to 4 (variable)	26	K-bS
Rolling terrain, irregular	Mg-R,R(Mg), R(Wf)	4-5	27	Sp-K-bS
Rolling terrain, irregular	R	1	28	Bak
Narrow valley, gently sloping	O/M,Mg,Md	6*	29	Ca-bF
Local depression, running water near peat margin	O/M,Mg,Md	6*	29	Swp

Table III-2 (Contin.)

Land Form And Position	Surficial Deposit	Drainage Class	Soil Series	Climax Vegetation
Flat or raised bog	deep Ob	6	30	Boo
Border of raised bog, seepage from bog	shallow Ob	6, 6*	31	Bom
Flat or large depressions	Ofy (1m)	6*	32	Fed
Lower seepage slope	Ofe (1m)	6*	33	Fes
Various positions on slopes, generally over drumlins	Ofb (40-50 cm)	6*	34	Fes
Flooded area around beaver dam	Om	6*	35	Mab
Floodplain	Om	6*	35	Maf
Estuary	Om, Et	6*	36	Mae
Bare bedrock	R	0	37	Rock

140 in all. For the purpose of this classification, shoreline ecosections are defined as "linear segments of the littoral extending in width from the line of low tide up to normal forest land. They are delineated on the basis of configuration, surficial deposits, exposure and dynamic processes". Table III-3 provides a description of the location of each of the thirty shoreline ecosections, while Map III-2 shows its location on the coast.

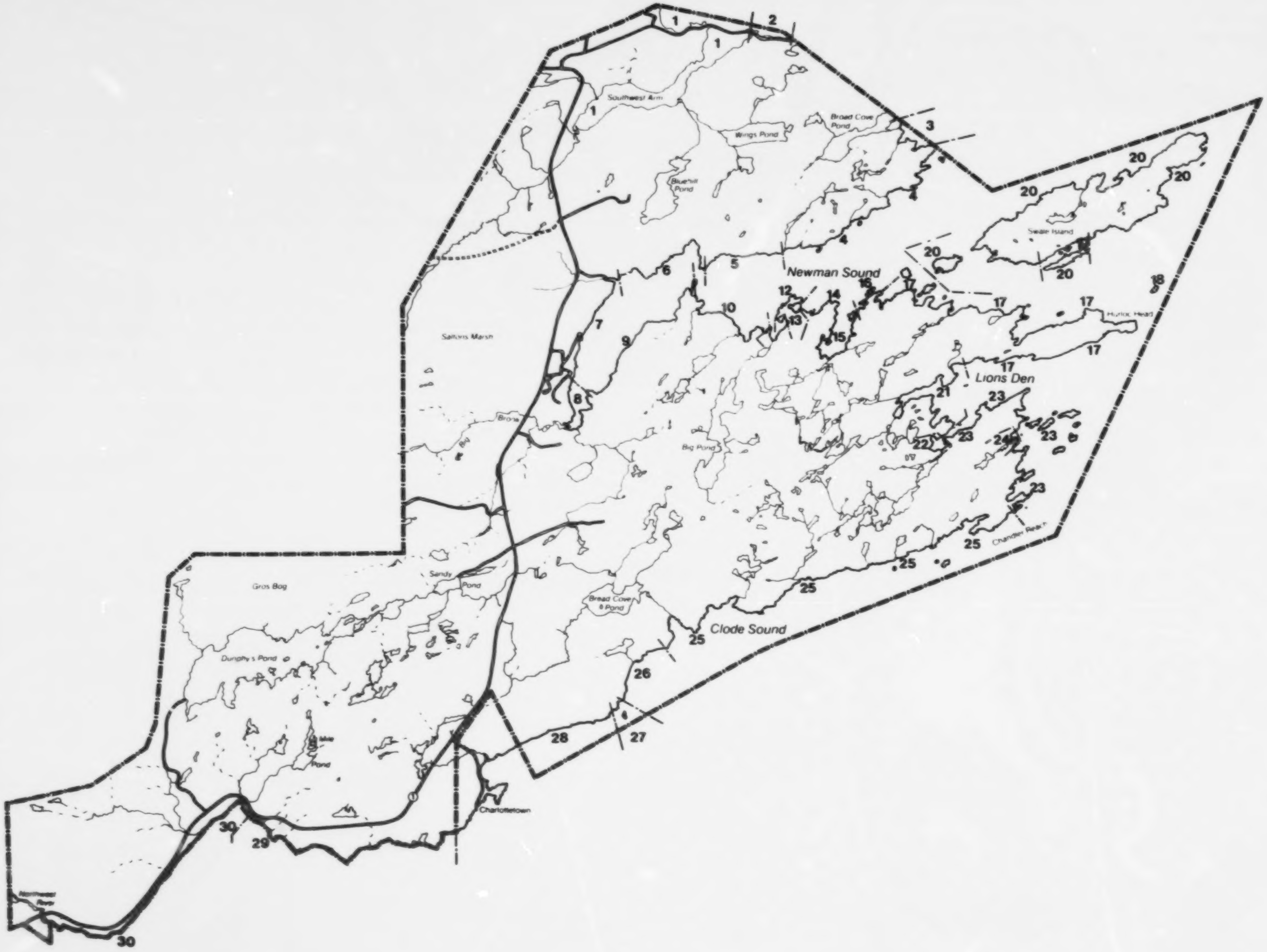
Table III-3

Location Description of Thirty Shoreline Ecosections Found in Terra Nova National Park

Number	Description
F-1	Beach Cove, Southwest Arm, Broad Cove
F-2	Alexander Bay - Outside Southwest Arm Causeway
F-3	North Broad Cove
F-4	Cockes Cove to Forked Island Cove
F-5	Forked Island to Buckley Point
F-6	Buckley Point to Salton's Wharf
F-7	Salton's Estuary to edge of Big Brook River tidal flats
F-8	Big Brook River flats
F-9	Edge of Big Brook tidal flats to Sound Tickle
F-10	Sound Tickle to Minchin Cove Point
F-11	Minchin Cove
F-12	Minchin Head from outer (east) point of Minchin Cove
F-13	Little South Broad Cove (inner cove - west)
F-14	Little South Broad Cove to South Board Cove Wharf
F-15	South Board Cove Wharf along east shore to South Board Cove
F-16	Outer South Board Cove (east)
F-17	Big Cold East to Cockes Cove and Hurloc Head to outer section of Lion's Den - Woody Island
F-18	Copper Island
F-19	Seal Island Tickle

Table III-3 (Contin.)

Number	Description
F-20	Shoreline of Swale Island, outer Seal Island and larger White Island
F-21	Outer Southern Den, Southern Den to Park Harbour Narrows
F-22	Park Harbour
F-23	Park Harbour Narrows, Oldfords Islands and on to Shag Point area
F-24	Field Harbour
F-25	Shag Point to Bread Cove
F-26	Bread Cove Point to Platter's Beach area
F-27	Platter's Beach and Island
F-28	Platter's area to Charlottetown
F-29	Charlottetown to Platter Cove area
F-30	Platter Cove to South Boundary


Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Newman Sound
Saltons Marsh
Big Pond
Lions Den
Swale Island
Hurloc Head
Chandler Reach
Clode Sound
Bread Cove & Pond
Sandy Pond
Gros Bog
Dunphy's Pond
Mile Pond
Charlottetown
Northwest River

Terra Nova National Park

MAP III-2

Shoreline Ecosections of
Terra Nova National Park

F-1	Beach Cove, Southwest Arm, Broad Cove
F-2	Alexander Bay - Outside Southwest Arm Causeway
F-3	North Broad Cove
F-4	Cockes Cove to Forked Island Cove
F-5	Forked Island Cove to Buckley Point
F-6	Buckley Point to Salton's Wharf
F-7	Salton's Estuary to Edge of Big Brook River Tidal Flats
F-8	Big Brook River Flats
F-9	Edge of Big Brook Flats to Sound Tickle
F-10	Sound Tickle to Minchin Cove Point
F-11	Minchin Cove
F-12	Minchin Head from Outer (East) Point of Minchin Cove
F-13	Little South Broad Cove (Inner Cove - West)
F-14	Little South Broad Cove to South Broad Cove Wharf
F-15	South Broad Cove Wharf Along East Shore to South Broad Cove
F-16	Outer South Broad Cove (East)
F-17	Big Cold East to Cockes Cove and Hurloc Head to Outer Section of Lion's Den - Woody Island
F-18	Copper Island
F-19	Seal Island Tickle
F-20	Shoreline of Swale Island, Outer Seal Island and Larger White Island
F-21	Outer Southern Den, Southern Den to Park Harbour Narrows
F-22	Park Harbour
F-23	Park Harbour Narrows, Oldfords Islands to Shag Point Area
F-24	Field Harbour
F-25	Shag Point to Bread Cove
F-26	Bread Cove Point to Platter's Beach Area
F-27	Platter's Beach and Island
F-28	Platter's Area to Charlottetown
F-29	Charlottetown to Platter Cove Area
F-30	Platter Cove to South Boundary

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

Photo III-1. Beach at Dumpling Cove (Ecosection F-25) in a moderately protected area of Clode Sound. Beach is relatively stable with coarser materials being located in the lower tidal zone.

Photo III-2. Beach at Southwest Arm (Ecosection F-1) in very sheltered location showing three distinct wrack lines representing different high tide heights.

REFERENCES

Canada Committee on Ecological (Biophysical) Land Classification, 1977. Ecological (Biophysical) Land Classification in Canada: Proceedings of the First Meeting of the Canada Committee on Ecological (Biophysical) Land Classification, 25-28 May, 1976, Petawawa, Ontario.

Gauthier, Poulin, Theriault, Ltd., 1977. A Biophysical Classification for Terra Nova National Park. Terra Nova National Park, Glovertown, Newfoundland.

Section IV

HYDROLOGY

T. Ingledow (1970) subdivided the Province of Newfoundland into five hydrologic regions or zones with the possibility of further subdivisions. These zones were based on the physiographic and climatological data as collected for the "Water Resources Study, Newfoundland and Labrador" commissioned by the Atlantic Development Board. The five zones are shown in Map IV-1 and are as follows:

1. Southeastern Newfoundland - with the possibility of subdivision into two parts by separation of the Avalon Peninsula;

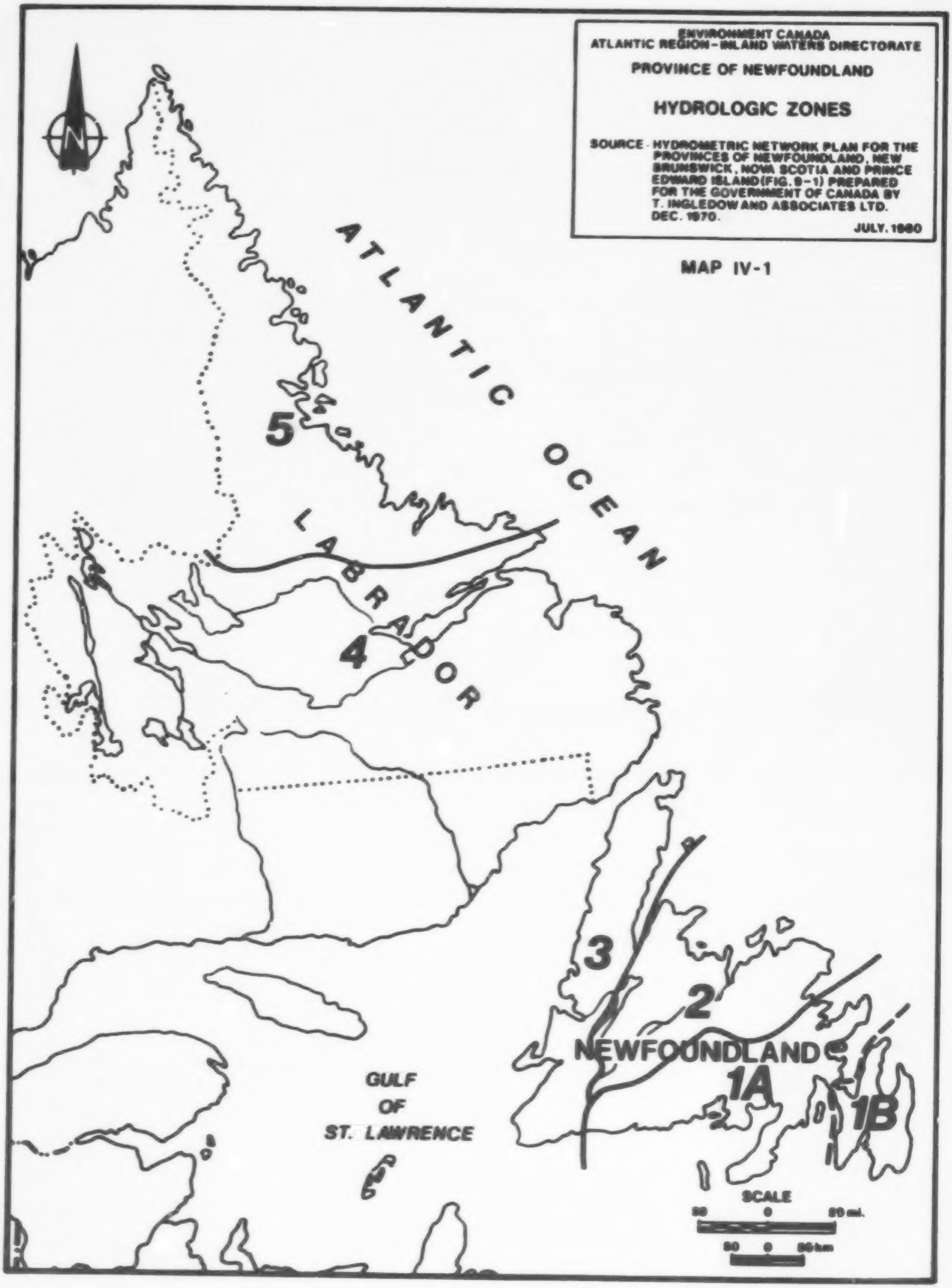
2. North-Central Newfoundland - the Grand Lake catchment, although draining to the west, belongs physiographically and hydrologically to north-central Newfoundland;

3. Western Newfoundland;

4. Southern Labrador;

5. Northern Labrador.

Terra Nova National Park is located in sub-division 1A of Zone 1.



ENVIRONMENT CANADA
ATLANTIC REGION - INLAND WATERS DIRECTORATE

PROVINCE OF NEWFOUNDLAND

HYDROLOGIC ZONES

SOURCE - HYDROMETRIC NETWORK PLAN FOR THE PROVINCES OF NEWFOUNDLAND, NEW BRUNSWICK, NOVA SCOTIA AND PRINCE EDWARD ISLAND (FIG. 9-1) PREPARED FOR THE GOVERNMENT OF CANADA BY T. INGLEDOW AND ASSOCIATES LTD. DEC. 1970.

JULY, 1980

MAP IV-1

N
ATLANTIC OCEAN
5
LABRADOR
4
3
2
NEWFOUNDLAND
1A
1B
GULF OF ST. LAWRENCE
SCALE
50 0 50 mi.
50 0 50 km

Ponds and Brooks of Terra Nova National Park

The general flow of watershed systems in the park is to the northeast. In close proximity to the sea, the fifty watersheds have not formed well developed drainage patterns. 134 ponds present total 24 square kilometres in area, constituting approximately 6 per cent of the park. A total of 66 brooks are found within park boundaries of which only 3 are classed as "intermittent". In an ecological land classification of the park, water bodies were classified as standing open water (ponds) or running water (brooks). Table IV-1 shows the classification of ponds by watershed, size, depth, drainage, basin topography, and surficial deposits. Table IV-2 provides the classification of brooks by watershed, width, permanence, basin topography and surficial deposits.

Explanation of Symbols Used in Table IV-1

Class

1 - 0-5 ha

2 - 5-20 ha

3 - 20-250 ha

4 - 250-2 000 ha

5 - +2 000 ha

Sub-class

1 - deep open water +5 m

2 - shallow open water .3-5 m

3 - open water marsh .3-5 m

4 - intermittent open water

Drainage System

1 - Open drainage - inlets and outlets

2 - Restricted drainage - outlets

3 - Closed drainage - no inlets or outlets

Basin Topography and Shape

1 - Horizontal
  - a) regular ratio: 1.0-1.5
  - b) irregular 1.5-3.0
  - c) very irregular 3 : 1

2 - Vertical
  - a) gently sloping 0-5%
  - b) moderately sloping 6-15%
  - c) steeply sloping +16%

Surficial Deposits

R	Bedrock
Wf	Weathering deposits
Mg	Ground Moraine
Md	Drumlin
Ml	Lateral moraine
Mh	Hummocky moraine
Mr	Reworked till
Ge	Esker
Go	Outwash deposits
Gd	Delta
Bsg	Marine sediments
Lsg	Lacustrine sediments
Fp	Fluvial plain
Fl	Alluvial levee
Fd	Raised delta
Et	Estuarine sediments
Ss	Scree slope
Ob	Bog
Ofy	Deep fen
Ofe	Shallow fen
Ofb	Very shallow fen
Om	Marsh
O	Undifferentiated organic slopes
Mg(R)	Shallow ground moraine
Mg-R	Very shallow ground moraine
R-Mg	Bedrock with pockets of ground moraine

Table IV-1

Classification of Ponds in Terra Nova National Park
By Watershed, Size, Depth, Drainage,
Basin Topography, and Surficial Deposits

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography V	Basin Topography H	Surficial Deposits and Percent of Shoreline Covered
1. Square Pond	46	3	1	2	b	a	Ofe, Md 55 45
2. Arnold's Pond	50	1	2	1	b	a	Mg 100
3. Green Hill Pond	45	1	1	1	c	a	R(Mg), Ofe 85 15
4. Jay Pond	44	2	1	2	b	a	Mg(R) 100
5. Green Hill Pond south	44	2	1	1	b	b	R(Mg), Ofy 95 5
6. Pond #6	44	1	2	1	b	a	Ofy, Mg(R) 80 20
7. Little Broad Cove Pond	43	2	1	1	b	c	Mg-R, O 60 40
8. Wings Pond	44	3	1	1	c	a	Mg(R), Md, O 15 35 20
9. Broad Cove Pond	21	3	1	1	c	b	Ofe-Ofy, R-Mg, Mg-R, Mg, 10 40 7 10 Lsg, Bsg, R 10 10 3

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin V	Topography H	Surficial Deposits and Percent of Shoreline Covered
10. Tilleys Cove Ponds	43	2	1	2	b	b	Mg(R) 100
11. Fork Island Pond	41	2	2	2	b	a	R-Mg 100
12. Pond #12	42	1	2	2	c	b	Mg, O 80 20
13. Long Pond North	41	2	1	2	c	b	R-Mg 100
14. Pond #14	39	1	1	3	c	a	R-Mg 100
15. Buckley Cove South	39	1	2	2	b	a	R-Mg 100
16. Buckley Cove Pond North	44	1	1	2	b	a	Mg(R), R, Ofy 50 45 5
17. Little Wings Pond	44	2	1	1	b	b	Mg, Md, Mg(R), Ofy 60 20 15 5
18. Bluehill Pond N	40	2	1	2	b	b	Mg-R, Md, Ob 65 30 5
S	40	2	1				

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography		Surficial Deposits and Percent of Shoreline Covered
					V	H	
19. Davey Ann's Pond	50	2	1	1		b	Ofe, (R) 100
20. Pine Hill Pond	50	1	2	2	a	a	Mg, Ofy 95 5
21. Garlands Pond	50	1	2	1	b	a	Ofy, Mg, Ofe 60 30 10
22. Kellys Pond	50	1	2	1	b	a	Mg 100
23. Southwest Pond	50	1	2	1	b	b	Ofy 100
24. Pond #24	50	1	2	2	b	a	Ofe 100
25. Pond #25	50	1	2	1	b	a	Mg, Ofy 60 40
26. Pond #26	49	1	1	1	c	a	Gd 100
27. Rocky Pond	34	2	1	2	c	a	Mg(R), O 85 15
28. Muskrat Pond	34	1	2	1	b	b	Mg(R), Mg, R, O 55 20 15 10

Table IV-1 (Contin)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography		Surficial Deposits and Percent of Shoreline Covered
					V	H	
29. Pond #29	32	1	2	1	a	a	Mg(R), O 80 20
30. School Pond	32	2	1	1	c	a	Mg(R) 100
31. Crooked Pond	32	1	2	1	b	b	Mg(R), O 85 15
32. Pond #32	32	1	2	2	b	a	Mg(R), O 95 5
33. Mount Stamford Pond	33	1	2	2	b	a/b	Mg(R), O 60 40
34. Hefferns Cove Pond	32	2	1	1	c	a	Mg(R), O 92 8
35. Minchin Pond	32	2	1	1	c	a	Bsg 100
36. Juiceys Pond N North S	20	2 2	1 2	1 1	c b	a a	N) R(Mg) S) R(Mg), Lsg 100 95 5
37. Muddy Pond	20	1	2	1	b	a	Mg(R), O 80 20
38. Big Pond	22	3	1	1	b		Mg(R), Bsg, O 72 20 8

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography V	H	Surficial Deposits and Percent of Shoreline Covered
39. Butts Pond	22	1	2	1	b	b	Mg(R), O 75 25
40. Brown Marsh Ponds south	20	1	1	1	b	b	Mg(R), O, R 72 10 8
41. Kettle Pond south	20	1	1	1	b	a	Mg(R), O, R 72 10 8
42. Kettle Pond north	20	1	1	1	c	a	Mg(R), O, R 72 10 8
43. Pond #43	20	1	2	1	b	b	Mg(R) 100
44. Pond #44	20	1	2	1	b	b	Mg(R), O 92 8
45. Diamond Pond	20	2	1	1	b	b	Mg(R), O 95 5
46. Barneys Pond	26	2	1	1	c	a	Mg(R), O 65 35
47. Ship Cove Ponds north	24	1	2	1	b	b	Mg(R) 100
48. Mosses Cove Pond	30	2	1	2	c	b	R 100

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin V	Topography H	Surficial Deposits and Percent of Shoreline Covered
49. Rescue Cove Pond	29	1	2	3	b	a	R 100
50. Marks Shute Pond	28	1	1	2	b	a	Mg(R), O 95 5
51. Valley Pond	28	1	1	2	c	a	Mg(R), O 70 30
52. Ship Cove Pond south	24	2	2	2	b	b	Mg(R) 100
53. Pond #53	28	1	1	3	c	a	Mg(R) 100
54. Bates Pond	51	1	2	2	b	b	Mg(R) 100
55. Lion Pond west	19	2	2	1	b	a-b	Mg(R), O 60 40
56. Lion Pond east	19	1	1	1	b	a	Mg(R), O 95 5
57. Hancocks Pond	19	2	1	2	b	b	Mg(R), O 95 5
58. Moose Pond	19	2	1	1	c	a	Mg(R), O 98 2

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography		Surficial Deposits and Percent of Shoreline Covered
					V	H	
59. Goose Pond	20	1	2	2	b	c	Mg(R) 100
60. Little Duck Pond	51	2	1	1	c	a	Mg(R) 100
61. Clay Pond	19+16	1	1	1	c	b	Mg(R), O 95 5
62. Spruce Pond	16	3	1	1	c	c	Mg(R), O 95 5
63. Park Harbour Pond	16	2	1	1	b	b	Mg(R), O 75 25
64. Rattle Pond	16	3	1	1	b	b	Mg(R), O 97 3
65. Field Harbour Pond	17	2	2	2	b	b	Mg(R), O 85 15
66. Pond #66	17	1	1	3	c	b	Mg(R), O 90 10
67. Pond #67	17	1	1	3	b	a	Mg(R) 100
68. Mill Pond	17	2	2	2	b	b	Mg(R) 100

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography V	Basin Topography H	Surficial Deposits and Percent of Shoreline Covered
69. Shallow Pond	16	1	2	1	b	a	Mg(R), O 95 5
70. Half Mile Pond	17	1	1	2	b-c	a	Mg(R), O 75 25
71. Grassy Cove Pond	15	1	2	1	b	a	Mg(R) 100
72. Duck Pond	15	1	2	1	b	a	Mg(R), O 90 10
73. Bog Ponds north	15	2	1	1	c	b	Mg(R), R, O 50 30 20
74. Bog Ponds south	15	2	1	1	c	b	Mg(R), R, O 50 30 20
75. Pond #75	14	1	2	3	b	a	Mg(R), O 90 10
76. Pond #76	14	1	2	1	b	b	Mg(R), O 95 5
77. Pond #77	14	1	1	2	b	a	Mg(R), O 90 10
78. Double Pond	14	2	1	1	b	b	Mg(R), O 95 5

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography		Surficial Deposits and Percent of Shoreline Covered
					V	H	
79. Powder Pond	21	2	1	2	c	b	Mg(R) 100
80. Jack Ponds north	21	2	2	1	b	c	Mg(R), O, R 65 30 5
81. Jack Ponds south	21	1	2	1	b	a	Mg(R) 100
82. Puzzle Pond	34	1	2	2	b	c	O, Mg(R), R 60 30 10
83. Ochre Hill Ponds north	34	1	2	2	b	b	Mg(R), O, R 50 45 5
84. Ochre Hill Ponds south	34	1	2	2	b	b	Mg(R), O 95 5
85. Pond #85	21	1	2	2	b	a	R, Mg, O 40 40 20
86. Fox Pond	21	1	1	2	c	b/a	R, O 75 25
87. Chatman Ponds west	21	1	2	1	b	b	Mg, O 95 5
88. Chatman Ponds east	21	1	2	2	b	b	Mg, Md 60 40

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography		Surficial Deposits and Percent of Shoreline Covered
					V	H	
89. Beaver Pond	21	2	2	1	b	a	Mg(R), Md, O 45 45 10
90. Grassy Pond	21	1	2	1	b	a	O, Mg(R) 90 10
91. Pond #91	35	1	2	1	b	b	O 100
92. Charlie Chaulk's Pond	35	2	1	1	b	b	Mg(R), O 55 45
93. Sandy Pond	21	3	2	1	b	a	Mg(R), O, Lsg 45 45 10
94. Gull Pond	35	2	2	1	b	a	O 100
95. Lond Pond South	21	2	2	2	b	a	Mg(R), Mg, O 65 25 10
96. Pond #96	21	2	2	2	b	b	R, O, Mg 70 20 10
97. Dunphy's Pond	21	4	1	2	b	b	R-Mg, Mg-R, Bsg, Mg, Lsg, 40 17 10 10 10 Ofe-Ofy, R 10 3

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography		Surficial Deposits and Percent of Shoreline Covered
					V	H	
98. Spracklin Pond	21	1	1	1	b	a	Mg(R), Md, O 50 40 10
99. Lost Pond	21	2	2	1	b-c	a	Mg(R), Mg, O 70 20 10
100. Island Ponds north	21	2	1	1	b	b	Mg(R), O 80 20
101. Island Ponds center	21	1	1	1	b	c	Mg(R), O 92 8
102. Island Ponds south	21	1	1	2	c	b	Mg(R) 100
103. Haleys Pond	21	1	2	2	b	b	Mg(R), O 95 5
104. Saw Pit Pond	21	1	1	2	c	b	Mg(R) 100
105. Moon Pond	21	1	2	3	b	b	Mg(R) 100
106. Bread Cove Pond	21	3	1	1	c	b	Mg(R), Bsg, O 50 20 15
107. Johnstons Pond	11	2	1	1	b	b	Mg(R) 100

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin V	Topography H	Surficial Deposits and Percent of Shoreline Covered
108. Little Trout	21	1	2	1	b	a	Md 100
109. Trout Pond	21	2	2	2	b	a	Md 100
110. Twin Ponds north	8	1	2	2	b	b	Mg(R), O 85 15
111. Twin Ponds south	8	1	2	2	b	b	Mg(R), O 90 10
112. Odeas Pond	8	1	2	1	b	b	Mg(R), O 75 25
113. Chaulk Pond	8	1	2	2	b	b	Mg(R), O 90 10
114. Yuddle Pond N	8	1	1	1	b	b	N) Mg, O S) Mg(R), O 85 15 40 40
S		1	2	1	b	b	
115. Friday Pond	21	2	2	2	b	b/a	Mg(R), O 60 40
116. Our Ponds south	21	1	2	2	b	a	Mg(R), O 95 5
117. Our Ponds north	21	1	2	1	b	b	Mg(R), O 95 5

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography		Surficial Deposits and Percent of Shoreline Covered
					V	H	
118. Otter Pond	21	1	2	2	b	a	Mg(R), O 95 5
119. Little Rocky Pond	21	1	2	2	b	a	O, Mg(R) 75 25
120. Long Water N S	21	3 3	2 2	1 1	b b	b/a b/a	Mg(R), O 60 40
121. White Pond Pond	7	2	2	1	b	a/b	Md, O, Mg(R) 40 40 20
122. Mile Pond	5	3	1	1	c	c	Mg(R), Mg, Md, O 90 4 3 3
123. Pond #123	21	1	2	2	b	a	Mg(R), O 70 30
124. Pond #124	21	1	2	1	b–c	a	O, Mg(R) 70 30
125. Simmonds Pond	4	2	2	2	b	b	Mg(R), O 60 40
126. Blind Pond	4	2	2	1	b	b	Mg(R), O 97 3
127. Pond #127	2	1	2	3	c	a	Mg(R), O 85 15

Table IV-1 (Contin.)

Name and Number of Pond	Watershed Number	Class (size)	Sub-Class (depth)	Drainage	Basin Topography V	Basin Topography H	Surficial Deposits and Percent of Shoreline Covered
128. Jucieys Pond south	2	2	2	2	b	a	Mg(R), O 90 10
129. Pond #129	2	1	2	2	b-c	a	O, Mg(R) 90 10
130. Pond #130	2	1	2	2	b-c	a	Mg, O 40 60

Explanation of Symbols
Used in Table IV-2

Class

1 - less than 2 m
2 - 2-20 m
3 - 20-100 m

Sub-class

1 - permanent
2 - periodic
3 - intermittent

Basin Topography and Shape

1 - Horizontal
  a) straight
  b) curved
  c) sinuous
  d) meandering
  e) meandering with oxbows
  f) braided
  g) beaded
  h) dendritic

2 - Vertical

a) gently sloping	0-5%
b) moderately sloping	6-15%
c) steeply sloping	16%+

Surficial Deposits

R	Bedrock
Wf	Weathering deposits
Mg	Ground moraine
Md	Drumlin
Ml	Lateral moraine
Mh	Hummocky moraine
Mr	Reworked till
Ge	Esker
Go	Outwash deposits
Gd	Delta
Bsg	Marine sediments
Lsg	Lacustrine sediments
Fp	Fluvial plain
Fl	Alluvial levee
Fd	Raised delta
Et	Estuarine sediments
Ss	Scree slope
Ob	Bog
Ofy	Deep fen
Ofe	Shallow fen
Ofb	Very shallow fen
Om	Marsh
O	Undifferentiated organic deposits
Mg(R)	Shallow ground moraine
Mg-R	Very shallow ground moraine
R-Mg	Bedrock with pockets of ground moraine

Table IV-2

Classification of Brooks in Terra Nova National Park
By Watershed, Width, Permanence,
Basin Topography, and Surficial Deposits

Name and Number of the Brook	Watershed Number	Class (width)	Sub-Class (Permanence)	Basin Topography		Surficial Deposits and Percent of Segment Covered
				H	V	
1. Southwest Arm inlet	45	1	3	c	c	Mg, Bsg 50 50
2. Square Pond outlet	46	1-(2)	1	c	b-c	Mg, Bsg, Ofe 60 20 20
3. Arnolds Pond outlet	50	1	1	c	c c	R-Mg, Mr 70 30
4. Southwest Brook a)	50	2	1	c	c c	a) Mg, Mg-R, Ofy 80 15 5
b)				c	b c	b) Ofe, Mg, Mr 45 40 15
c)		1	1	c	b c	c) Mg-R, Mg, Ofy 15 78 7
5. Wings Brook Southwest Arm inlet a)	44	1	1	c	b-c	a) Bsg, Mg(R), Ofe 75 15 10
b)		1	1	c	c	b) Mg, Bsg, Md, Ofe, Ofy 30 25 20 20 5
6. Wings Pond inlet	44	1	1	c	c c	Mg-R 100
7. Jay Pond Green Hill Pond	44	1	1	c	c-b c	Mg(R), Ofy 90 10

Table IV-2 (Contin.)

Name and Number of the Brook	Watershed Number	Class (width)	Sub-Class (Permanence)	Basin Topography		Surficial Deposits and Percent of Segment Covered
				H	V	
8. Little Broad Cove Pond outlet	43	1	1	b	c c	Mg(R), Ofe 55 45
9. Shag Pond outlet	42	1	1	c	b–c c	Mg–R, O 85 15
10. Donald Smith's Pond outlet	42	1	1	c	c c	Mg–R, O 95 5
11. Forked Island Ponds outlet	41	1	1	c	c c	R–Mg, O 75 25
12. Long Pond North outlet	41	1	1	c	c–b c	Mg–R, O 88 12
13. Pond "122" outlet	5	1	1	b	c c	R 100
14. Buckley Cove Pond outlet	39	1	1	b	b c	Mg 100
15. Salton's Brook	38	2	1	c	a–b c	Go 100
16. Ramp Wharf inlet	36	1	1–3	c	c c	Mg, Mg(R) 30 70
17. Big Brook a)	49	2	1	c	c,b	Mg, O, Fd
b)		2	1	d	c,c	75 22 3

Table IV-2 (Contin.)

Name and Number of the Brook	Watershed Number	Class (width)	Sub-Class (Permanence)	Basin Topography H	Basin Topography V	Surficial Deposits and Percent of Segment Covered
18. Charlie Chaulk's Pond inlet	35	1	3	c	a c	O 100
19. Terra Nova Brook	a) 35 b)	1 1	1 1	c b	b c,b	a) O, Md b) O, Fp 85 15 85 15
20. Ochre Hill and Fox Pond outlet	34	1	1	c	c–b c	O, R 85 15
21. Muskrat Pond outlet	34	1	1	c	b c	Mg(R) 100
22. Rocky Pond outlet	34	2	1	c	c c	Mg(R), O 80 20
23. Cannings Cove inlet	33	1	3	c	c c	Mg-R 100
24. Mount Stamford Pond outlet	33	1	1	c	c c	Mg, O 70 30
25. Hefferns Cove Pond outlet	32	1	1	c	c c	Mg-R 100
26. Big Pond outlet	22	2	1	c	b–c c	O, Bsg, Mg(R) 70 20 10
27. Big Pond inlet	22	1	1	c	c c	R-Mg, O, Bsg 60 30 10

Table IV-2 (Contin.)

Name and Number of the Brook	Watershed Number	Class (width)	Sub-Class (Permanence)	Basin Topography H	V	Surficial Deposits and Percent of Segment Covered
28. Kettle Pond outlet	20	1	1	b	b-c	Mg(R), O 70 30
29. Lions Pond outlet	19	1	1	b	c c	Mg(R) 100
30. Valley Pond outlet	28	1	1	a	c c	O, Mg(R) 70 30
31. Park Harbour Pond outlet	16	1	1	c	c c	Mg(R), O 70 30
32. Brook #32	17	1	1	b	b c	Mg(R), O 70 30
33. Mill Pond outlet	17	1	1	b	b c	Mg 100
34. Half Mile Pond	17	1	2	c	b c	Mg(R), O 90 10
35. Brook #35	16	1	1	c	b c	Mg(R), O 95 5
36. Duck Pond outlet	15	1	1	c	b c	O, Mg(R) 95 5
37. Brook #37	17	1	1	a	c	Mg(R), O 90 10

Table IV-2 (Contin.)

Name and Number of the Brook	Watershed Number	Class (width)	Sub-Class (Permanence)	Basin Topography H	Basin Topography V	Surficial Deposits and Percent of Segment Covered
38. Grassy Cove outlet	15	1	1	c	c c	Mg(R), O 95 5
39. Double Pond outlet	14	1	1	c	b c	Mg(R), O 70 30
40. Jacks Pond Powder Horn Pond outlet	21	1	1	c	b c	O, Mg(R) 60 40
41. Bread Cove Pond inlet	21	1	1	c	c c	Mg(R), O 95 5
42. Bread Cove Pond outlet	21	2	1	b	c c	Mg(R), O 60 40
43. Bread Cove Brook a) b)	21	2 2	1 1	c c-d	c-b,c a,c	a) Fp, Om b) Fp, Om 50 50 50 50
44. Little Trout Pond outlet	21	1	1	c	b c	Md 100
45. Johnstons Pond outlet	11	1	1	b	c c	Mg(R) 100
46. Chatmans Pond outlet	21	1	1	c	c c	Mg, R 70 30
47. Sandy Pond outlet	21	2	1	c	a-b c	O 100

Table IV-2 (Contin.)

Name and Number of the Brook	Watershed Number	Class (width)	Sub-Class (Permanence)	Basin Topography H	Basin Topography V	Surficial Deposits and Percent of Segment Covered
48. Beachy Pond outlet	21	1	1	c	b-c c	O 100
49. Spracklin Pond outlet	21	1	1	c	b c	Mg(R) 100
50. Dunphy's Pond inlet	21	1	1	c	b	Mg(R), O 90 10
51. Near Cobblers Picnic	1	1 1	1 1	a c	a c	Bsg, Mg(R) 60 40
52. Cobblers Brook	2	2	1	c	b c	Mg(R) 100
53. Platter Cove a) Blind Pond b) Outlet	10	2 2	1 1	c b	a,c b,c	a) Mg, Mg(R) b) Fp, Bsg 50 45 5 60 40
54. Platter Cove Mile Pond outlet	5	1	1	c	c c	Mg, Mg(R), O 50 48 2
55. Brook #55	6	1	1	c	b c	Mg, O 95 5
56. Brook #56	6	1	1	c	c c	Mg, O 95 5

Table IV-2 (Contin.)

Name and Number of the Brook	Watershed Number	Class (width)	Sub-Class (Permanence)	Basin Topography H	Basin Topography V	Surficial Deposits and Percent of Segment Covered
57. Brook #57	6	1	1	c	c	Mg, O
					c	95 5
58. White Point	7	1	1	c	c	Mg(R), Md
Pond Outlet					c	50 50
59. Twin Brook	8	1	1	c	b	Mg(R), O
Yudle Pond outlet				c	c	95 5

Tables IV-1 and IV-2 show the classification of each pond and brook in the park. The following is a synthesis of that classification according to surface area, depth and drainage for ponds and width and permenance for brooks.

Ponds

Class 1. 76 ponds (0-5 ha)
  Sub-class 1 - 22 ponds (deep - 75 m)
    2 - 54 ponds (shallow - .3-5 m)
  Drainage 1 - 37 ponds (inlets and outlets)
    2 - 31 ponds (outlets only)
    3 - 8 ponds (neither)

Class 2. 46 ponds (5-20 ha)
  Sub-class 1 - 28 ponds (deep - 75 m)
    2 - 18 ponds (shallow open .3-5 m)
  Drainage 1 - 27 ponds (inlets and outlets)
    2 - 19 ponds (outlets only)

Class 3. 11 ponds (20-250 ha)
  Sub-class 1 - 8 ponds (deep - 75 m)
    2 - 3 ponds (shallow open - .3-5 m)
  Drainage 1 - 10 ponds (inlets and outlets)
    2 - 1 pond (outlets only)

Class 4. 1 pond (250-2000 ha)
  Sub-class 1 - 1 (deep - 75 m)
  Drainage 2 - 1 (outlets only)

Brooks

Class 1. 53 brooks (less than 2 m wide)
  Sub-class 1 - 50 brooks (permanent)
    2 - 1 brook (periodic)
    3 - 3 brooks (intermittent)
  NOTE: 1 brook has sections in each sub-class

Class 2. 13 brooks (2 - 20 m wide)
 Sub-class 1 - 13 brooks (permanent)

Watershed Units of Terra Nova National Park

The watersheds vary in size from those of Mosses Cove Pond and South Broad Cove at one square kilometre each to that of Dunphy's Pond at 75 square kilometres. Relatively little data has been collected on water volumes from the various watersheds. However, a gauging station was located at Rocky Pond Brook during the period 1959-1963, and a second station, established in 1967, is still operative on Southwest Brook which drains a 39 square kilometre watershed. Some data has also been collected in recent years from the Northwest River.

Peak monthly flows for Southwest Brook occur during the period of January to June, resulting from a combination of heavy rainfall, thawing temperatures and consequent rapid snow melt. The mean annual discharge rates in cubic metres per second for Southwest Brook during the ten-year period 1970-1979 are shown in Figure IV-1.

Minimum flows occur in the summer months reflecting the effect of several variables, such as increased solar insolation and evapo-transpiration, and decreased relative humidity. Other factors, such as total rainfall, rainfall pattern, higher infiltration and geological conditions may have an additional effect. Smaller brooks go dry periodically during July with relatively dry conditions prevailing until October.

The fall precipitation restores water in the surface vegetation mat and in the winter months precipitation is

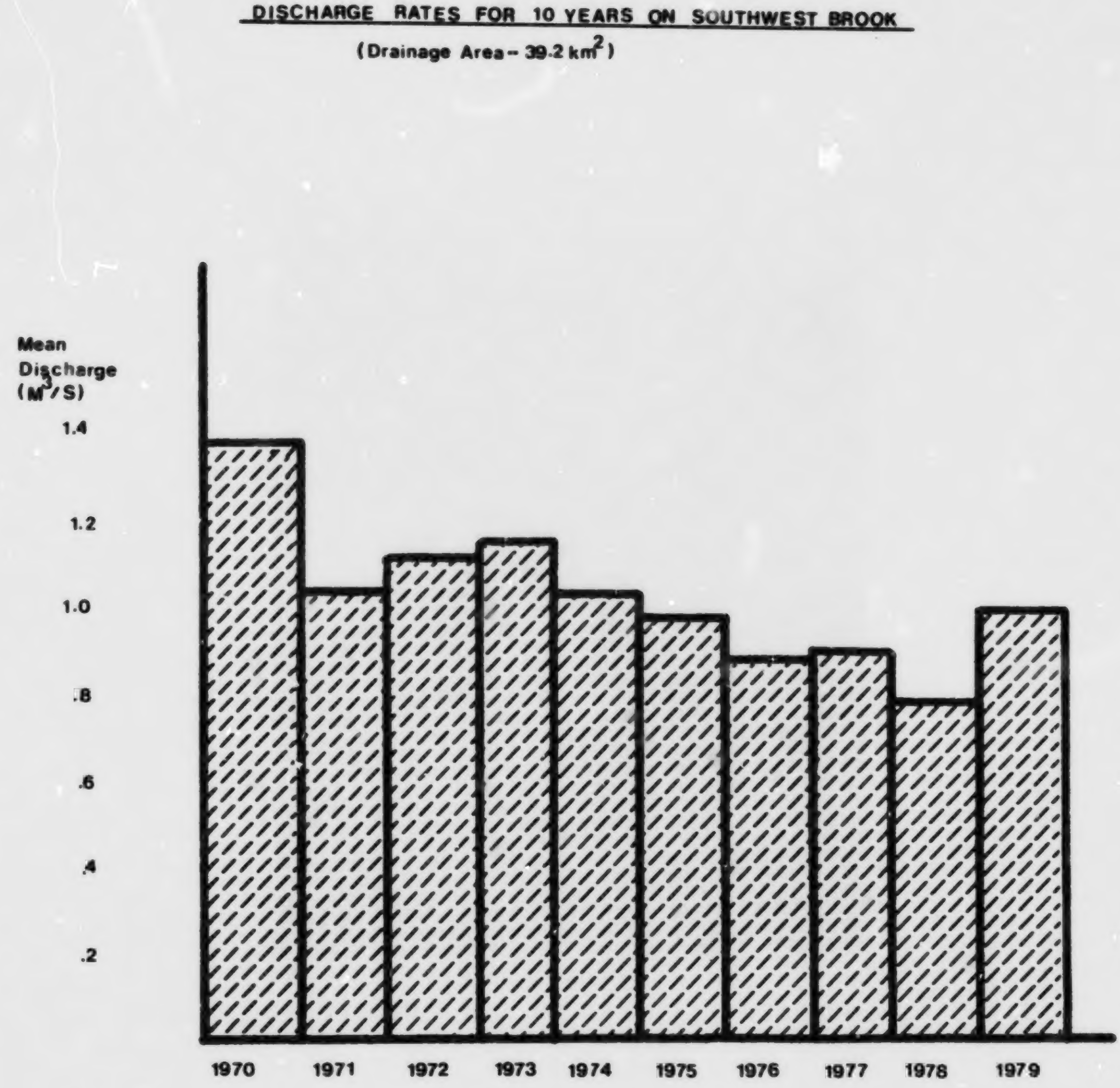

DISCHARGE RATES FOR 10 YEARS ON SOUTHWEST BROOK
(Drainage Area – 39.2 km^2)
Mean Discharge (M^3/S)
1.4
1.2
1.0
.8
.6
.4
.2
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979

FIGURE IV-1

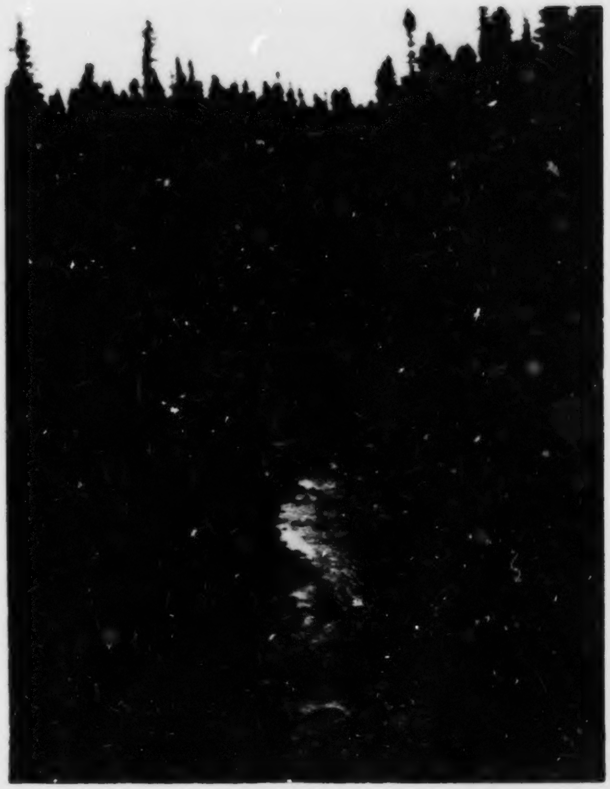


Photo IV-1. Bread Cove Brook looking downstream from the Trans Canada Highway. It is an example of a Class 2 (Sub-class 1) brook. Note marked gradient and boulder filled channel.

locked in the snow cover. During the late winter and early spring months, most of the precipitation runs off directly. Frequent fogs decrease evapo-transpiration in the late spring.

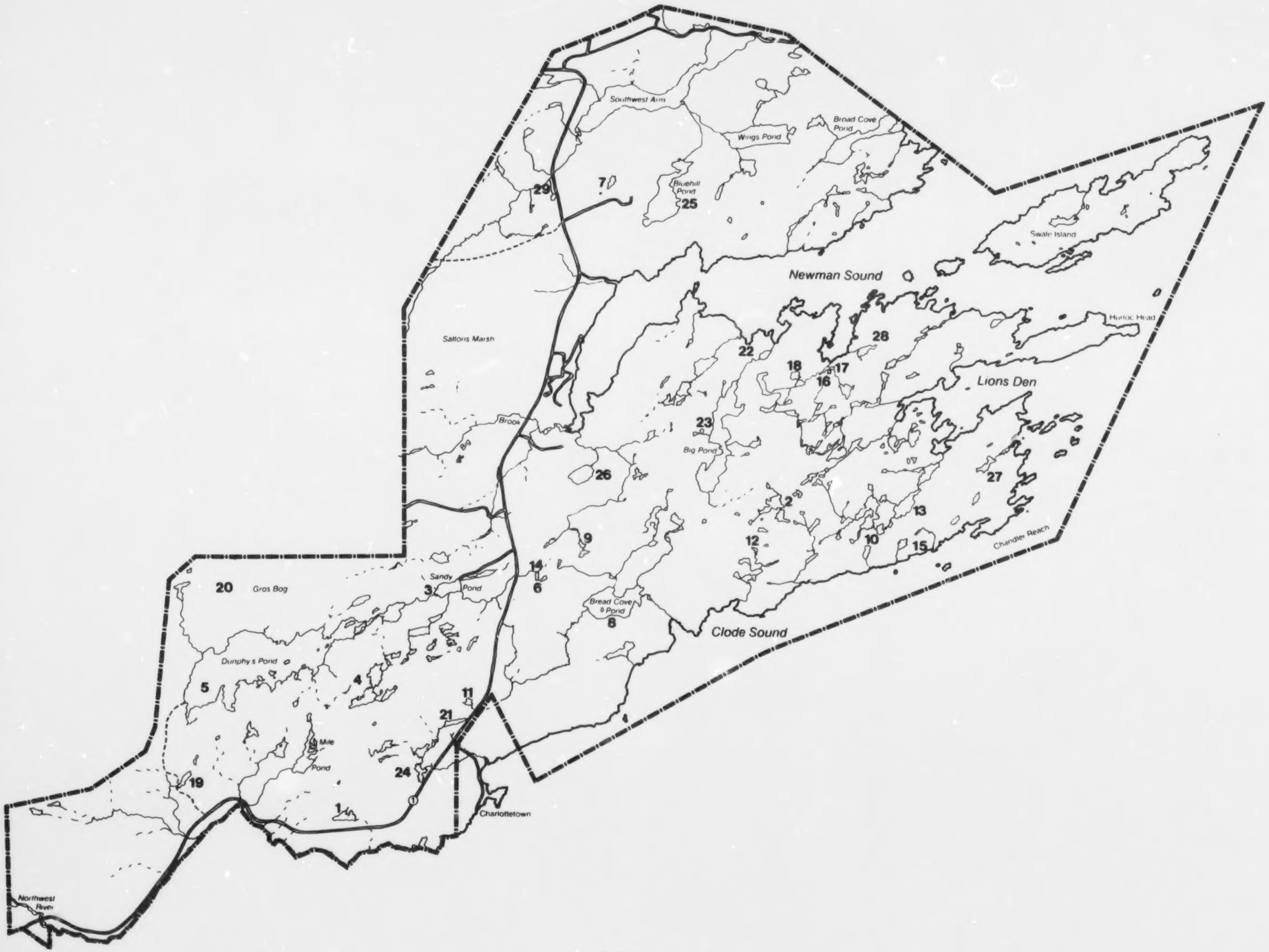
Water level reaction of the Northwest River to heavy rainfall was recorded over a 24-hour period on May 5, 1980, when 62.6 mm of rain was recorded. The tideboard was read for the four following days to determine the extent of and the time taken for the river to attain peak levels. It was noted that it took three days for the level of the stream to rise from 1.05 m on May 15, 1980, and reach its peak at 1.22 m on May 18, 1980. This level is the second highest recorded on the river.

Many other park watersheds have small ponds which moderate stream flow. Water storage is essentially in the moss root mat of duff layer. Soils of the park have platy fragipan development or other impermeable horizons which slow downward seepage of excess surface waters.

Chemical Characteristics of Pond Waters

Intensive limnological studies were carried out on 29 ponds in Terra Nova National Park by the Canadian Wildlife Service starting in 1965. The locations of the selected ponds are shown in Map IV-2. A chemical description of the ponds sampled is provided in Table IV-3 with ponds being listed in order of increasing salinity. The low salinity levels are a reflection of the poor soil conditions in the park, which lies almost entirely in Precambrian rock.

Alkalinity is considered as an important index in estimating pond productivity. The alkalinity values ranged from 1.4 ppm (Bog Pond North and Dunphy's Pond) to 8.2 ppm (Pine Hill


Southwest Arm
Broad Cove Pond
Wings Pond
Bluehill Pond
Swale Island
Newman Sound
Hurloc Head
Saltons Marsh
Lions Den
Brook
Bog
Big Pond
Chandler Reach
Gros Bog
Sandy Pond
Bread Cove & Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
Northwest River
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29

Terra Nova National Park

MAP IV-2

Locations Of Twenty-Nine Ponds
Sampled in Limnological Studies
In Terra Nova National Park

1) White Point Pond
2) Bog Pond North
3) Sandy Pond
4) Long Waters South
5) Dunphy's Pond
6) Chatman's Pond East
7) Davey Ann's Pond
8) Bread Cove Pond
9) Ochre Hill Pond
10) Shallow Pond #3
11) Litte Trout Pond
12) Bog Pond (Southwest)
13) Rattle Pond
14) Chatman Pond (West)
15) Mill Pond
16) Nameless #1
17) Nameless #2
18) Nameless #3
19) Juicey's South
20) "Bog"
21) Trout Pond
22) Minchin Pond
23) Big Pond
24) Yudle Pond
25) Bluehill Pond
26) Rocky Pond
27) Field Harbour #1
28) Barney's Pond
29) Pine Hill Pond

Parks Canada
Atlantic Region
kilometers
1 0 1 2 3 4
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Table IV-3
Chemical Composition Of 29 Pond Waters In Terra Nova National Park
(Listed In The Order Of Increasing Salinity)
(Colour In Hazen Units)

No.	Lake	Salinity	Alkalinity	Hardness	Ca++	Mg++	Na+	K+	HCO3-	SO4-	Cl-	Si02-	pH Field	pH Laboratory	Color
									Parts per million						
1.	White Point	9.7	2.9	4.7	1.8	0.1	1.8	0.1	3.5	1.6	2.6	0.1	6.9	6.5	20
2.	Bog (North)	10.1	1.4	3.4	1.3	0.1	2.1	0.1	1.7	2.4	3.2	0.2	6.5	5.9	40
3.	Sandy	11.4	2.3	4.4	1.5	0.2	2.1	0.1	2.8	2.1	3.1	0.9	6.6	6.2	20
4.	Long Waters (South)	11.4	2.4	4.7	1.7	0.1	2.8	0.1	2.9	1.9	3.2	0.2	6.7	6.3	20
5.	Dunphy's	11.6	1.4	3.6	1.4	0.1	2.1	0.1	1.7	2.1	3.7	1.4	6.8	6.2	20
6.	Chatman (East)	12.3	3.1	5.7	2.0	0.2	2.1	0.1	3.7	2.6	3.1	0.3	6.3	6.3	70
7.	Davey Ann's	12.7	2.8	4.9	1.6	0.2	2.5	0.3	3.4	2.4	3.8	0.2	6.4	6.2	50
8.	Bread Cove	13.3	3.0	5.3	1.9	0.1	2.2	0.1	3.7	2.2	3.1	1.9	6.7	6.1	30
9.	Ochre Hill (North)	14.1	3.8	6.4	2.2	0.2	2.7	0.2	4.6	2.0	3.8	0.7	6.7	6.2	15
10.	Shallow #3	14.2	2.0	5.5	1.4	0.5	3.3	0.2	2.4	2.4	4.9	0.3	6.9	6.3	15
11.	Little Trout	14.2	3.4	6.4	2.2	0.2	2.7	0.1	4.1	2.7	3.1	0.2	6.7	6.3	20
12.	Bog (Southwest)	14.3	2.8	7.7	2.3	0.5	2.3	0.1	3.4	2.5	4.6	0.3	6.5	6.0	140
13.	Rattle	14.5	2.2	5.5	1.4	0.5	3.2	0.2	2.7	1.6	5.4	0.5	6.9	6.4	10
14.	Chatman (West)	14.6	4.0	6.3	2.1	0.3	2.5	0.1	4.9	3.6	3.6	1.1	6.3	6.2	60
15.	Mill	16.2	3.5	7.0	0.8	1.2	3.8	0.2	4.2	1.6	5.9	0.1	—	6.6	5
16.	"Nameless" #1	16.8	4.0	6.4	2.3	0.2	3.2	0.3	4.9	3.3	4.6	0.5	6.9	6.9	10
17.	"Nameless" #2	16.8	4.9	7.0	1.8	0.6	3.3	0.3	6.0	2.6	4.7	—	6.5	6.4	20
18.	"Nameless" #3	17.0	3.8	6.9	2.7	0.1	3.1	0.2	4.6	2.3	5.4	1.0	6.7	6.1	80
19.	Juiceys South	17.1	4.8	6.8	2.4	0.2	2.9	0.3	5.9	2.7	4.8	0.8	6.9	6.4	20
20.	"Bog"	17.1	8.0	9.3	3.0	0.4	2.9	0.2	9.8	1.5	3.7	0.6	7.0	6.5	90
21.	Trout	17.3	3.6	7.1	2.6	0.1	3.2	0.1	4.4	3.6	4.8	0.7	6.7	6.3	30
22.	Minchin	17.6	3.5	7.0	2.5	0.2	2.8	0.1	4.3	3.0	4.5	2.5	6.7	6.5	40
23.	Big	18.1	3.8	6.6	2.6	0.1	2.9	0.2	4.6	2.9	4.8	2.4	6.9	6.3	40
24.	Yudle	18.9	7.2	11.1	3.6	0.5	2.8	0.2	8.8	2.5	4.4	0.6	7.0	6.6	10
25.	Bluehill	20.4	5.8	8.6	3.2	0.1	3.3	0.2	7.1	2.6	4.9	2.6	7.0	6.6	10
26.	Rocky	21.0	5.2	7.5	2.9	0.1	3.0	0.3	6.3	3.4	4.7	3.6	6.9	6.6	40
27.	Field Harbour #1	24.6	8.7	10.0	2.6	0.9	5.9	0.3	10.6	1.6	8.0	0.1	—	6.9	10
28.	Barneys	25.9	3.0	8.5	1.8	1.0	5.9	0.4	3.7	3.3	9.6	2.8	—	6.5	20
29.	Pine Hill	41.1	8.2	22.8	7.3	1.1	5.8	0.4	10.0	7.1	14.0	0.5	7.1	6.8	5
	Snow melt	2.7	0.0	0.6	0.2	0.03	0.5	0.1	0.0	0.8	1.1	tr.	—	5.1	—

Sample taken at work camp

Pond). Alkalinity/salinity ratios are an indication of productivity. A comparison of park waters' alkalinity/salinity ratios indicate a low productivity potential. (Kerekes, 1968)

Hardness values lay between 3.4 ppm in Bog Pond North and 22.8 ppm in Pine Hill Pond. With the exception of Yudle Pond (11.1 ppm) and Pine Hill Pond (22.8 ppm) the hardness values did not exceed 10 ppm. Therefore, all waters would be considered as very soft. (Kerekes, 1968)

The ionic content was not uniform in the waters examined with sodium being the dominant cation in 17 ponds, calcium in 10 ponds and in 5 ponds the proportions of these two ions were equal. Chloride was the dominant anion with the exception of Yudle Pond and Bog Pond, where bicarbonate surpassed chloride as the dominant anion.

Chloride and sodium are the major ions in sea water. The relatively high proportion of these ions in the waters of the park is the reflection of the proximity of these ponds to the ocean.

The following is a summary of the findings of the study involving the 29 ponds selected within the park:

1. The general range of salinity was between 10 and 26 ppm. One pond, Pine Hill, had an exceptional salinity (40.1 ppm).

2. All waters were very soft, typical of waters having drainage from igneous rocks.

3. The range of total alkalinity was between 1.4 and 8.2 ppm.

4. All waters were chloride types, with the exception of Yudle Pond which was a bicarbonate type.

5. The pH of surface waters varied between being mildly acidic (pH 6.3) and nearly neutral (pH 7.1) during the ice-free period.

6. Lakes receiving waters from peatlands had highly coloured waters and were relatively high in iron and manganese.

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Section V

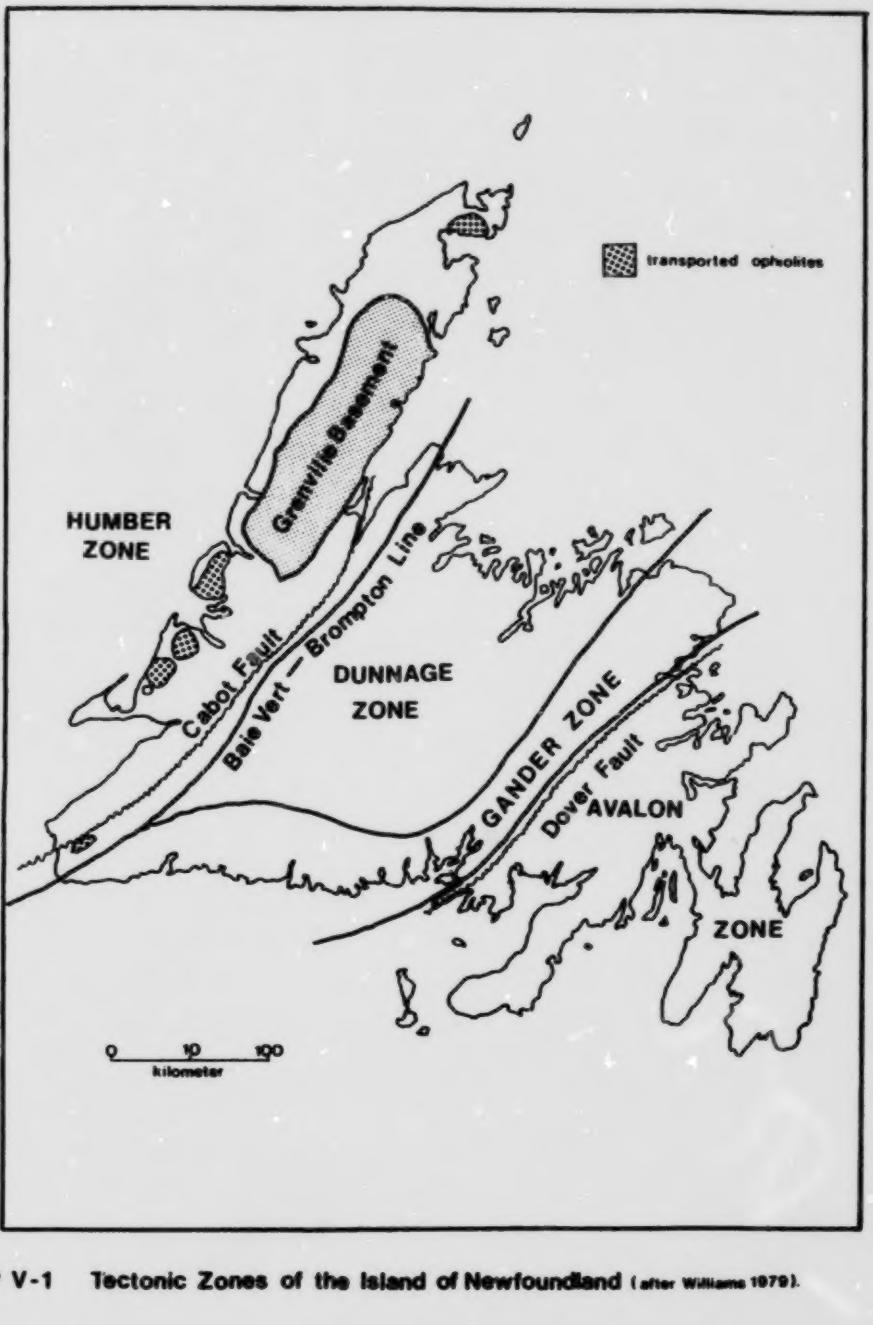
GEOLOGY/GEOMORPHOLOGY

In general, the Island of Newfoundland, although rugged, possesses no areas of great relief except the Long Range Mountains which parallel the western coast. The major physiographic features are determined by a series of very old, worn-down fold-ridges with axes trending from northeast to southwest. As a result of glaciation, the surface of the Island is covered by unconsolidated deposits of variable depth and great complexity. Insular Newfoundland has been divided into "tectonic zones" arranged from west to east (Map V-1) and called the Humber, Dunnage, Gander and Avalon Zones respectively. Terra Nova National Park is located in the Avalon Zone.

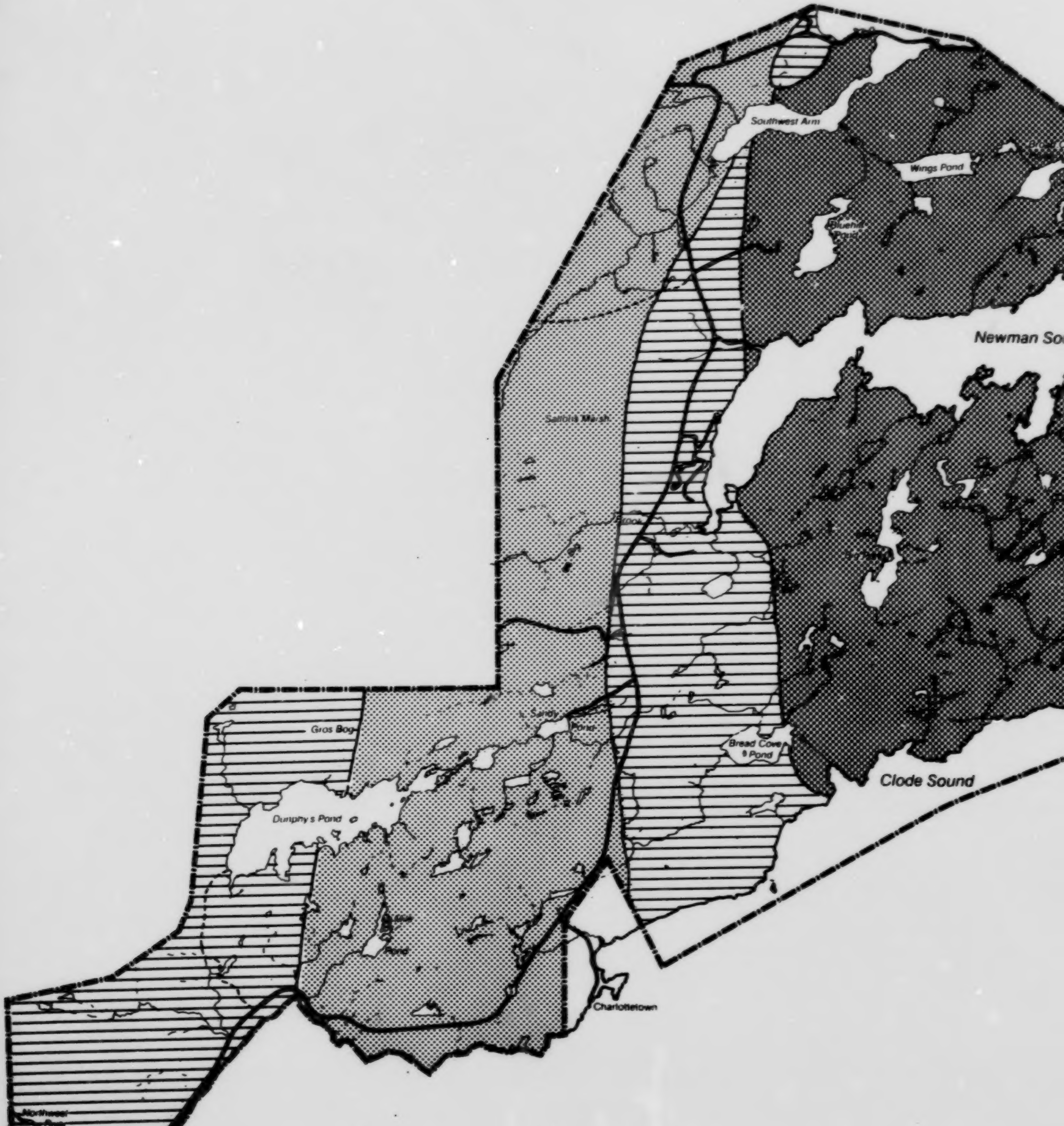
Bedrock Geology

Terra Nova National Park belongs to the Appalachian Mountain system and is composed of a variety of Precambrian rocks, three groups being particularly well represented: the Love Cove Group, the Connecting Point Group and the Musgravetown Group (Refer to Map V-2).

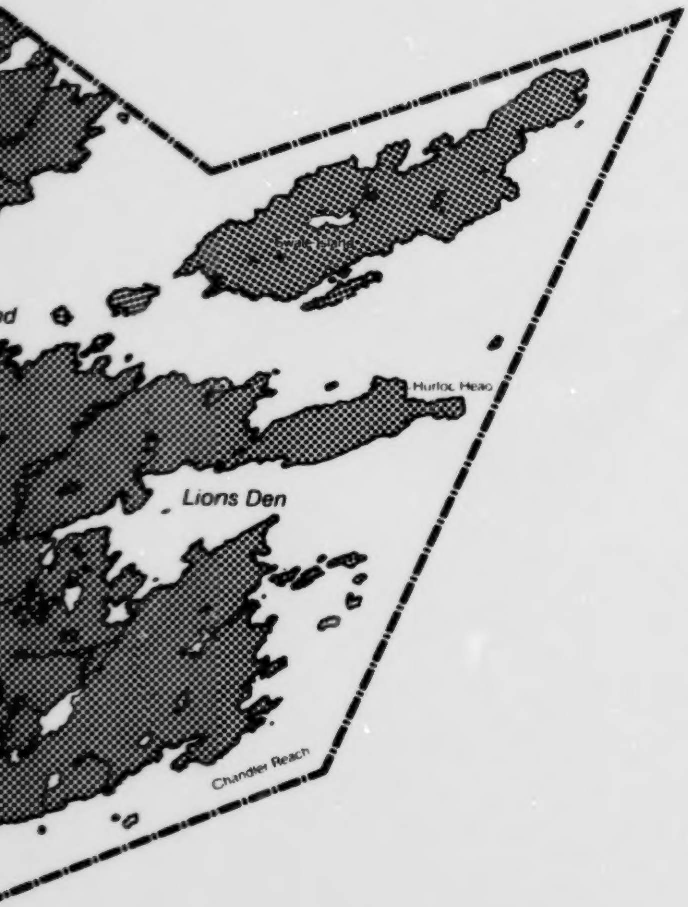
Of mixed facies, the Love Cove Group includes clastic sediments, lavas and pyroclastic rocks, all of which are regionally metamorphosed. Pronounced schistosity is a characteristic of the rocks belonging to this group. Rock types most commonly found include: chlorite schists, chlorite sericite, schists, rhyolites, trachytes and andesites.


transported ophiolites
Grenville Basement
HUMBER ZONE
Cabot Fault
Baie Vert — Brompton Line
DUNNAGE ZONE
GANDER ZONE
Dover Fault
AVALON ZONE
0
10
100
kilometer

MAP V-1 Tectonic Zones of the Island of Newfoundland (after Williams 1979).


Southwest Arm
Wings Pond
Bluehill Pond
Newman So
Brook
Gros Bog
Sandy Pond
Bread Cove Pond
Clode Sound
Dunphy's Pond
Pond
Charlottetown
Northwest River

Terra Nova National Park


Swale Island
Hurloc Head
Lions Den
Chandler Reach

MAP V-2

Bedrock Geology Of Terra
Nova National Park

BASIC GEOLOGY

(fine) ░	**LOVE COVE GROUP** Schists and slates derived from volcanic rocks
▤	**MUSGRAVETOWN GROUP** Red and green sedimentary rocks
(coarse) ▓	**CONNECTING POINT GROUP** Fine-grained sedimentary rocks with volcanoes

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

The rocks belonging to the Connecting Point Group are slates (dark grey, black, grey and greenish grey) being the most abundant, followed by greywackes displaying various shades of grey to black and range in grain size from silt to coarse sand. Other rock types found in this group include greenish grey, cherty quartzites, conglomerates and some volcanic rocks.

The Musgravetown Group rocks are chiefly red and green coarse grained comglomerates, subgreywackes, arkoses and acidic to basic lavas of relatively shallow water, continental in origin. This group is represented by three formations in the park: the Cannings Cove Formation composed of a coarse red conglomerate with minor shale and siltstone, highly variable in thickness; the Bull Arm Formation is a thick volcanic unit consisting of basaltic lavas with interbedded red conglomerates and sandstones in the lower half and overlain by red, grey and purplish felsitic lavas; the Undifferentiated Middle Formation consists of a complex of clastic sediments of mainly red sandstones and shales.

Plutonic rocks are also present in the park. They include large bodies of Devonian granitic rocks, and many small dykes of Precambrian to Devonian or of a younger age.

Physiography

The relief of Terra Nova National Park has a general N. E.- S. W. trend. This characteristic may be observed by noting the orientation of Clode and Newman Sounds, as well as the general trend for fresh water bodies, such as Dunphy's Pond. In the eastern half of the park, this trend is the result of a monoclinal structure within the rocks. In the western half, linear glacial features are the main controlling factors.

A secondary trend, N.N.E. - S.W.W., also plays an important role in the distribution of the stronger relief of the area. Effectively, the high hills of Terra Nova National Park, Ochre Hill, Ochre "Pit" Hill and Mount Stamford on one hand, Blue Hill and Louil Hills on the other, are aligned on parallel bands along this orientation. The long axis of Big Pond, Blue Hill Pond, Mile Pond, as well as the orientation of South Broad Cove and Inner Newman Sound follow this structural trend. This secondary relief orientation seems to be in concordance with the trend of the major fault lines and the geological contacts between the rock formations (Gauthier et al, 1977).

It is interesting to note that the higher hill-tops of the park have concordant summits. Most hills, such as Blue Hill, Ochre Hill, Gros Bog and Park Harbour Hill range in height from 200 to 228 m. This phenomenum suggests a formerly flat erosion surface or sea floor that underwent subsequent uplift. A new cycle of erosion was then induced, eventually creating today's separate summits. The main force at work was the dissection by streams followed by subsequent modification by glaciers (D. Powell, personal observation).

The elevation of topography in the park varies from a depth of 290 m in Newman Sound and Chandler Reach, to an altitude of 278 m at Blue Hill (Hunter and Associates, 1972). Many echo soundings by vessels in the area indicate depths in excess of 325 m in the outer reaches of Newman Sound (Local Boatmen, personal comments). The deep troughs that exist north of Swale Island (F-20) and in Chandler Reach have U-shaped cross-sections. This indicates their former occupation by glaciers and thus they can be called fjords. This shoreline, deeply indented and dotted by offshore islands, is indicative of a submerged coastline. An ancient river valley system, with tributaries through Clode Sound, Newman Sound, and Alexander Bay, can be followed out into Bonavista Bay (Hunter and Associates, 1972).

Coastal relief is moderately high; for example, all along the coastline the 80 m contour is rarely more than one kilometer distance from the shoreline. Some hills, like Mount Stamford and Malady Head, dominate the shoreline. They have near vertical faces that rise to an elevation of 175 m. Ochre "Pit" Hill north of Clode Sound rises to an elevation of 152 m (Gauthier et al, 1977).

Drainage basins within the park are for the most part orientated toward the northeast, largely as a result of the coincidence of the northeasterly slope of the terrain and structural trends. The presence of stream systems such as Big, Bread Cove and South West Brooks might suggest that this area is well drained. This is not the case, however, due to the disruption of pre-existing drainage patterns by the last glaciation. Consequently, much of the local terrain is boggy and poorly drained. In this region of high precipitation, low evaporation, and only a moderate overall relief, existing drainage networks are prevented from rapidly removing surplus water. Even in areas of high relief where drainage is more active, extensive patches of bog occur between hills, thus hampering efficient drainage (Jenness, 1963).

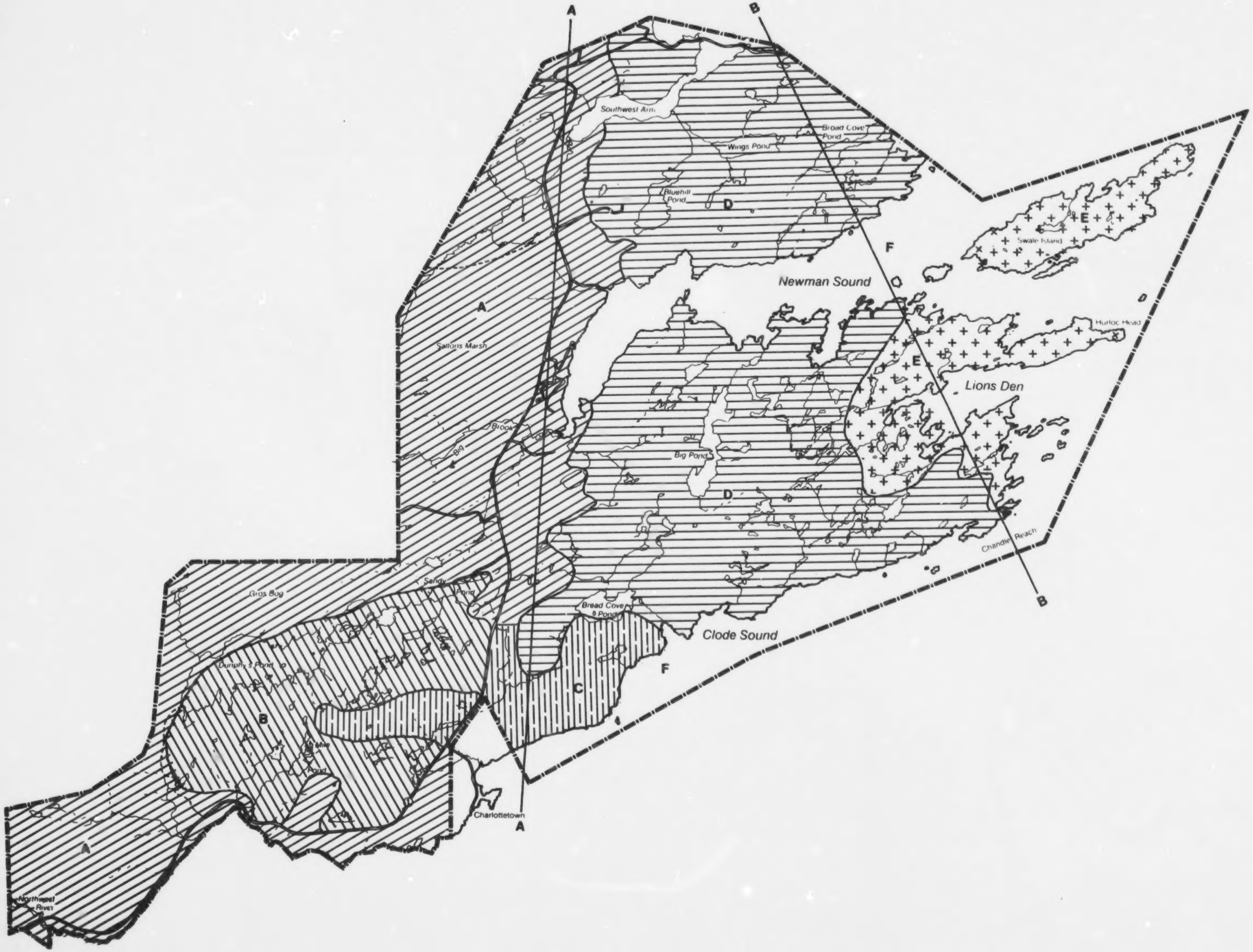
Geomorphology

Good data to picture the landscape development between the Precambrian and the Pleistocene Epoch does not exist. For this reason appraisals of possible phases of buildup and denudation will not be expanded upon here, as conclusions of such a study would at best remain broad approximations that could neither be proven or rejected. Since the last glaciation, the following regimes of events can be suggested. A late Pleistocene ice cap spread over Terra Nova National Park. Originating inland, the ice advanced in a S.W. - N.E. direction along local topographic lineaments until it reached presence of erratic boulders, glacial striations, drumlinoids and stoss-and-lee ridges such as Mount Stamford and Louil Hill (Map V-3 and Map V-3a). A subsequent warming in climate induced a melting, causing the ice-front to retreat landward from the coast. This resulted in ground and hummocky moraines being deposited. The mixed nature of these moraines suggests that frontal retreat was relatively rapid.

At the front of the retreating ice cap, as it stood at the head of the fjords, valley glaciers linked and fed by the main ice mass, occupied the deep valleys and calved into the sea. Lateral moraines, for the most part uncharted, were laid along the valley sides of Northeast Arm, Clode Sound and Newman Sound (Gauthier et al, 1977). There then followed an interval of cooler climate with the result of this cooling trend being a new and final ice-front forming inland in the vicinity of Dunphy's Pond. The result of this ice-front is an intensive end moraine that forms part of a discontinuous system transecting eastern Newfoundland. It is not known if this moraine system is merely a prolonged stopping point in a general retreat inland, or a secondary readvance of the ice-front (Jenness, 1963).

A second climate warming caused a rapid retreat in the ice-front and the subsequent formation of glacio-fluvial complexes in valley bottoms. Glacio-fluvial deltas of Big Brook, Southwest Brook and Salton's Brook were probably laid down as the ice-front was finally retreating near the western boundary of the park. There, elevation at 30 to 37 m

Terra Nova National Park

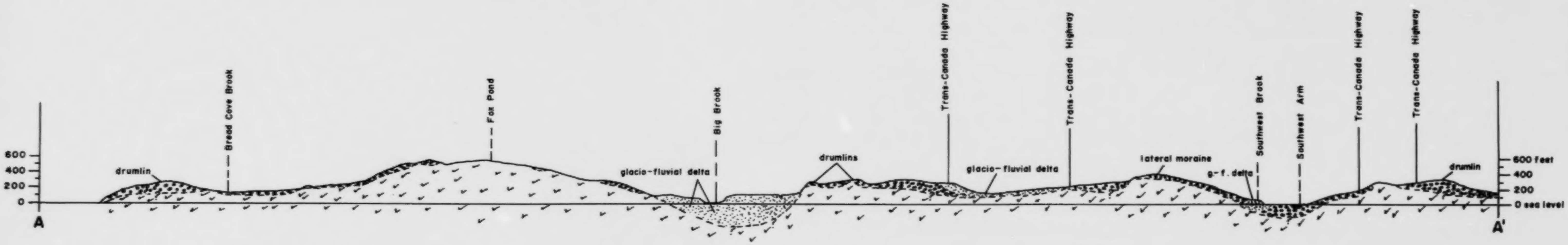

A
B
Southwest Arm
Broad Cove Pond
Wings Pond
Bluehill Pond
D
E
Swale Island
F
Newman Sound
Hurloc Head
Saltons Marsh
Lions Den
Brook
Big
Big Pond
D
Chandler Reach
Sandy Pond
Gros Bog
Bread Cove Pond
Clode Sound
F
Dunphy's Pond
C
B
Charlottetown
A
Northwest River
A
B

MAP V-3

Locations of Cross Sections
AA and BB

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4
N


Bread Cove Brook
Fox Pond
Big Brook
Trans-Canada Highway
Trans-Canada Highway
Southwest Brook
Southwest Arm
Trans-Canada Highway
Trans-Canada Highway
600
400
200
0
drumlin
glacio-fluvial delta
drumlins
glacio- fluvial delta
lateral moraine
g- f. delta
drumlin
600 feet
400
200
0 sea level
A
A'

▨ bedrock

▨ undiferenciated drift

▨ glacio fluvial sediments

■ water

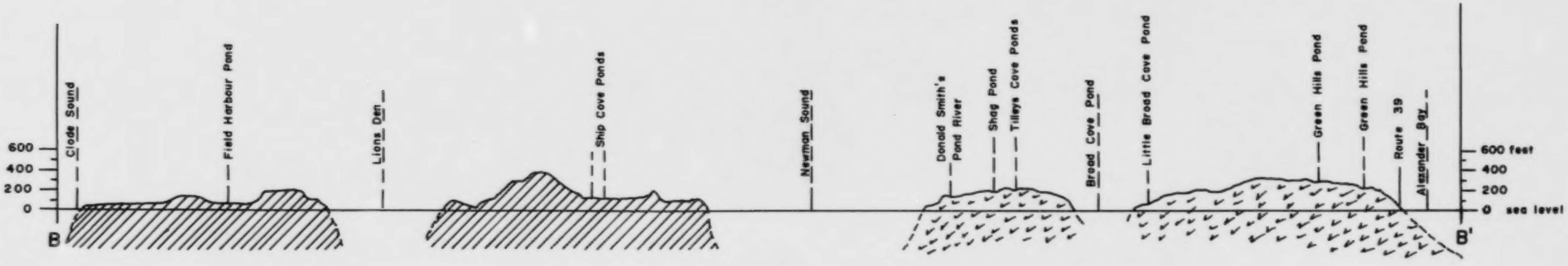
horizontal scale 1: 50,000

vertical exageration 4.16

0 2500 5000 10000 feet

CROSS SECTIONS A-A & B-B
SHOWING GLACIAL DEPOSITION
IN TERRA NOVA NATIONAL PARK

MAP V-3a


Clode Sound
Field Harbour Pond
Lions Den
Ship Cove Ponds
Newman Sound
Donald Smith's Pond River
Shag Pond
Tilleys Cove Ponds
Broad Cove Pond
Little Broad Cove Pond
Green Hills Pond
Green Hills Pond
Route 39
Alexander Bay
600
400
200
0
B
600 feet
400
200
0 sea level
B'

▨ rock strata perpendicular to cross section

▨ rock strata parallel to cross section

horizontal scale 1: 50,000

vertical exageration 4·16

0 2500 5000 10000 feet

seems to mark the local marine limit; however, evidence of a high marine transgression may yet be found (Gauthier et al, 1977).

After deglaciation, the continent was uplifted at a rapid rate, causing the sea to regress. In some places waves reworked the drift into beach deposits. Then, melt and surface waters dug the present valleys with their tendency to follow the lowered marine base level. Gulleys and terraces were formed at this time into the higher surfaces of the outwash deltas while new deltas were formed at lower levels. This process still continues and the flats of Big Brook, Salton's Brook and Southwest Brook are built of sands eroded upstream from the glacio-fluvial deposits (Gauthier et al, 1977). As suggested by the foregoing genesis, glacial, fluvio-glacial deposits, weathering and organic material, form most of the surficial deposits within the park. Glacial origin material or morainic deposit can be identified as ground moraine, hummocky moraine, lateral moraine, drumlin and reworked tills. Their grain-size and thickness vary according to their mode of deposition and the landforms in which they are found.

Ground moraine presents the largest range in grain-size distribution and lithology composition. Most of the time, it consists of silty medium sand accounting for 6 to 80% of the total mass. The remaining fraction consists of subangular granules, pebbles, cobbles and boulders. Ground moraine, where shallow or defrosted, can be easily eroded. This material, having a strong fraction of silt, may reach the liquid limit and slide when water saturated. For example, in Canning's Cove, Inner Newman Sound, an 80% slope shows evidences of instability. It is being affected by small slides, and creeps. The inclination of tree trunks also indicates that the slope is unstable. The drainage of ground moraine varies from well drained on upper slopes to imperfectly drained in depressions or on lower slopes.

Lateral moraines are built along the sides of a glacier occupying a valley, with silty sand accounting for less than 60% of the total mass. Boulders and cobbles are more frequent than in ground moraine. Three lateral moraines have been recognized in the park. The largest one, on the south side of Southwest Arm is disposed transversely to the bedrock structure. The second one is located between two of the Louil Hills parallel to Northeast Arm, and the third one lies parallel to it on Burn Point.

Hummocky moraine deposits consist of a succession of till knobs and a network of seepage channels flowing between the mounds. They were probably laid down during the melting of dead ice when the glacier was retreating. This moraine is found mostly around the intersection of the Trans Canada Highway, Terra Nova and Sand Pond roads.

Drumlins are elongated ridges parallel to the direction of ice flow. They consist of ground moraine shaped by ice pressure and glacier flow. Drumlin material matrix is fine to medium sand with less cobbles and boulders than ground moraine. Drainage varies from moderately well to excessively well drained. Drumlins are found in Ecodistricts A, B, C & D.

Some reworked tills are found on valley sides below the marine limit. They are characterized by the absence of fine materials, which were washed by waves.

Glacio-fluvial material is deposited by waters flowing within the glacier or at its margin and consists of stratified sand and gravel. Eskers, deltas, and out-washes are the three kinds of these deposits found in the park. They are concentrated at the bottom of valleys which are in some cases inland continuation of fjords. Drainage at the surface of glacio-fluvial deposits is usually excessive because of the high permeability of the material, but moderate drainage with seepage may occur at the base of terrace bluffs in the delta. The largest of these deposits is found in the Big Brook valley, where a glacio-fluvial complex comprising an outwash plan, an esker, a delta and some kettles can be followed from Terra Nova Lake to Newman Sound.

Organic deposits accumulate in standing water, enclosed depressions, and ponds under saturated conditions. Based on geomorphic and botanical criteria, we can define in Terra Nova National Park three types of organic deposits: bogs, fens, and marshes.

Bogs are peat covered areas, or peat filled depressions with a high water table. The bog surface is often raised. The deposit is fibrous in texture and consists of an accumulation of Sphagnum debris. Raised bogs in the park dominate surrounding topography by 1 to 3m. Their surface is undulating and presents small circular ridges. Depth of the deposit varies from 2m in Gross Bog to 6.5m in the bog near Bread Cove Pond. Some flats are also found in closed depressions of the bedrock.

Fens are found on very gently sloping terrain and on drumloid ridges. The material is mostly decomposed sedges and grasses. They present evidence of seepage. Their material depths range from over 1m to 30cm.

Marshes are found around lakes and streams. Periodically flooded, mineral sediments are mixed with decomposed grasses. They are generally shallow, their material depth scarcely exceeding 1 meter. Mostly localized along the actual stream, they consist of flood plain, alluvial levees, raised delta or discontinuous sheet cover of variable thickness (2-7m).

Flood plains consist of relatively flat alluvial deposits composed of 30 to 60 cm of undifferentiated materials overlying coarse sand.

Alluvial levees are located mostly along Bread Cove Brook upstream from Bread Cove Pond. They are composed of badly sorted sand and organic debris.

Raised deltas, 5-10m above sea level, are found around Southwest Arm and Buckley Cove. They are built of sand and gravel similar to the glacio-fluvial matrix.

Other fluvial deposits consist of discontinuous cover with variable thickness (2-7m) of very fine well sorted sand with silt and fine sand lamination. They lay over glacio-fluvial gravel.

Slope deposits are a product of geological structure, schistosity and freeze-thaw action. They form scree slope and talus at the base of rocky cliffs. The material consists of boulder with a matrix of small rock fragments and weathering boulders. In some cases, soil has developed on it and they are covered by vegetation.

Weathering deposits were derived from an in situ desintegration of the bedrock. They are found mostly in the eastern portion of the park where the absence of drift cover exposes frost sensitive schistes and fissured rocks to the freeze-thaw process. They cover a surface of approximately 3380 Ha and the soils formed on them are very stony.

Table V-1 classifies Terra Nova National Park's surficial material of differing origins as being primary, secondary, or tertiary, indicating the ecosections in which each is found and the area covered in hectares.

Table V-1
Classification of Terra Nova National Park's Surficial Material of Differing Origins As Being Primary, Secondary, or Tertiary, Indicating The Ecosections in Which Each is Found and Area Covered in Hectares.

LANDFORM AND, OR SURFICIAL MATERIAL	PRIMARY		SECONDARY		TERTIARY	
	Ecosection	Hectare	Ecosection	Hectare	Ecosection	Hectare
GLACIAL ORIGIN						
Ground moraine	A1	600	A11	233	A15	290
	A3	600				
	A4	502	A19	56		
	A5	170				
	A8	198	B1	253	D3	269
	A9	144	B4	69	D9	21
	A10	355				
	A17	1,286	D2	67		
	A21	367	D11	317		
			D15	44		
	C2	252				
	D7	204				
	D18	333				
	D19	168				
Bedrock/Ground Moraine	A11	233	A16	28	D14	61
	A14	195			D19	21
			D4	309		
	D1	237	D7	163		
	D2	469	D9	32		
	D5	867				
	D8	154				
	D10	752				
	D11	793				
	D12	326				
	D16	466				
	D20	785				
	E5	273				
Drumlin	A15	580	A1	360	A8	79
	A19	337	A5	48		
			A21	293	B4	69
	C3	801			D7	40
			D3	269		
			D13	57		
			D17	20		

Table V-1 (Contin.)

LANDFORM AND, OR SURFICIAL MATERIAL	PRIMARY		SECONDARY		TERTIARY	
	Ecosection	Hectare	Ecosection	Hectare	Ecosection	Hectare
Hummocky Moraine	A6	293				
	B5	306				
Lateral Moraine			A3	85	D1	47
					D2	67
Reworked Till	A18	181	A8	79	A1	119
			A17	256		
	B1	762			A19	56
	B2	360	B3	11		
	B4	533			D11	158
	B6	625	C2	252		
	D3	403	D5	123		
	D4	515	D14	61		
	D13	230	D18	200		
	D14	92	D19	21		
	D17	162				
GLACIO SLUVIAL ORIGIN						
Out Whases	A12	250	A6	176	A11	58
Glacio Fluvial Delta			A12	150		
ORGANIC ORIGIN						
Bog					A13	171
	B3	99	A7	182	D12	46
			A20	71		
	C1	45			D15	44
			B2	180	D20	392
			B6	178		
			C3	100		
			D16	155		

Table V-1 (Contin.)

LANDFORM AND, OR SURFICIAL MATERIAL	PRIMARY		SECONDARY		TERTIARY	
	Ecosection	Hectare	Ecosection	Hectare	Ecosection	Hectare
Bog (Contin.)			E3	36		
			E5	38		
			E6	44		
Fen					A3	85
					A5	24
	A2	105	A4	62	A6	58
			A9	96		
	A7	304	A10	39	A7	121
			A13	256	A17	256
	A13	427	A15	435	A19	48
	A20	89				
	D9	32	D8	22	B1	126
					B5	61
			D12	46	B6	89
					C1	30
			E4	168		
					C3	100
					D17	20
					D18	66
Other			D6	43	A4	62
					D5	123
			D10	107	D8	22
ALLUVIAL						
Alluvial Plain			A2	63	A12	50
			C1	45		
WEATHERING DEPOSIT	E1	401	D20	589	E5	38
	E2	316				
	E3	327				
	E4	1,348				
	E6	359				

NOTE: The above information was derived from the Terra Nova Biophysical Data Bank. For each of the fifty-six land systems, the principal surficial deposits (a maximum of 3) are listed along with an estimate of the area they cover.

Shoreline Morphology and Process

The shoreline of Terra Nova National Park is very irregular, being characterized by many interpenetrations of sea and land. While the sounds venture far inland, many heads and a large quantity of islands extend fragments of land into the sea. Known as a fjord coast, the coastal relief is not entirely built by marine action, but rather by the reworking of a continental relief by the sea. This on-going process is responsible for the diversity of relief found along the coast together with the continuing continental uplift. At the time of the park biophysical inventory, its shoreline was classified utilizing 30 ecosections. Table V-2 shows for each shoreline section the littoral ecoform, the littoral material, the dominant dynamic parameters, and the number of hectares involved.

A description of erosional and depositional processes together with a description of tidal pools and raised shoreline landforms follows.

Erosional Process: Along the coastline of Terra Nova National Park the dominant erosional formations are of mechanical origin. Most coastal features are the result of erosive action of waves combined with the freeze-thaw cycle of frost action, subordinate to the lithology and structure of local rock strata. The most commonly occurring formations include cliffs, abrasion platforms, notches, caves, stacks and arches (Gauthier et al, 1977).

Most cliffs in Terra Nova National Park are not the result of the wave action alone but rather the continuation of the general landscape topography that plunges into the sea. The structural attitude of the Connecting Point Group rocks

Key to Table V-2

Lit.01: Littoral Ecoforms

001 - Beach feed from erosion
007 - Tongue with bilateral alimentation
012 - Tombolo
034 - Small estuary
106 - Vertical cliff
111 - Tidal pool
113 - Rocky shoreline
201 - Ice drifted boulders

Lit.M1: Littoral Material

B-C - Boulders and cobbles
C-P - Cobbles and pebbles
P-S - Pebbles and sand
R - Rock
R-B - Rock and boulders
R-C - Rock and cobbles
S-O - Sand and organic debris

DOM.D1: Dominant Dynamic Parameters

F - Fluvial influence
IF - Floating ice
SH - Sheltered
T - Tide
WLF - Long fetch waves
WSF - Short fetch waves

Table V-2

Description of Shoreline Ecosections by Litoral Ecoform, Litoral Material, Dominant Dynamic Parameters, and No. of Hectares.

Shoreline Ecosection		Lit01	LitM1	DOMD1	Hect.
F	1	001	B-C	WSF	186
F	2	201	R-B	If	6
F	3	113	R	WLF	19
F	4	113	R	WLF	129
F	5	113	R	WLF	34
F	6	113	R	WSF	45
F	7	034	B-C	WSF	34
F	8	034	B-C	F	51
F	9	001	R	WSF	45
F	10	113	R	WLF	61
F	11	113	R-C	WSF	17
F	12	113	R-B	WSF	26
F	13	001	P-S	WSF	1
F	14	113	R-B	IF	51
F	15	113	R-B	WSF	34
F	16	113	R-B	WLF	22
F	17	106	R	WLF	354
F	18	106	R	WLF	12
F	19	012	R-C	WSF	32
F	20	106	R	WLF	393
F	21	106	R	WLF	111
F	22	113	R	SH	14
F	23	106	R	WLF	292
F	24	111	R-B	T	3
F	25	113	R	WLF	249
F	26	113	R	WLF	44
F	27	007	C-P	WLF	14
F	28	201	B-C	WSF	39
F	29	001	R-C	WSF	123
F	30	001	R	WSF	108

(i.e., a general northeast strike and a dip ranging from 20° to 50°) is responsible for the concentration of cliffs east of Minchin Head in Newman Sound, east of Dumpling Cove in Clode Sound, and along the shore of Lion's Den, Oldford's Islands and Swale Island. In height, the sea cliffs of Terra Nova National Park vary from 15 to 45 m. and slope angles range from 35° to vertical and overhanging walls, such as those which occur on the north side of Hurloc Head, Park Harbour Point, Sugar Loaf Island and Swale Island.

Abrasion platforms can be seen in Terra Nova National Park in the softer Musgravetown rocks on the west shore of Bread Cove. They are, however, usually poorly developed in the harder rocks of the Connecting Point Group (Hunter et al, 1979).

Tidal notches found at the base of cliffs occur throughout the rocky coastal zone of Terra Nova National Park, especially in its northeastern section. Notches in the park are square in form, being accordant to the bedding planes of the sedimentary rocks. They are formed mainly by mechanical weathering; i.e., ice abrasion, freeze-thaw along the bedding planes. Biological and chemical weathering within the intertidal life zone are secondary (Gauthier et al, 1977).

Holes, caves and arches are common around the shoreline of Terra Nova National Park and are quarried into structural zones of weakness along joints, dykes and faults. Caves may be found at Matchims Cove on the north shore of Newman Sound, at Beach Head Cove in Newman Sound and on the south shore of Seal Island, while arches are quite common along the south shore of both Swale and Seal Islands.

Depositional Shore Features: The most common depositional or constructional shore features of Terra Nova National Park are beaches, tombolos, spits and deltas (Gauthier et al, 1977). These deposits consist mainly of gravel and sand accumulations with the form they take depending on varying combinations of currents and littoral drift. In addition, one large and several smaller tidal flats, as well as a few small salt marshes, are also found along the shores of Terra Nova National Park. Most of the depositional features are adjacent to Land Districts A and C, along the Inner Newman Sound shoreline, and inland of Clode Sound and Southwest Arm.

In Newman Sound, beaches formed from glacial drift are restricted in distribution, being limited to Buckley's Cove on the north shore, and Little South Broad Cove on the south shore. Along Clode Sound, shorelines originating from drift are not found further than half a mile east of Dumpling Cove.

While beach deposits in Southwest Arm and Inner Newman Sound are, in general, sandy and pebbly, those of Outer Newman Sound around Swale Island and Lion's Den are dominated by cobble and boulders. In Clode Sound, sandy beaches are also restricted to the inner more sheltered regions. The beaches originating from drift have a great variety of rock types in the cobbly, pebbly and sandy fractions since the drift itself is very heterogeneous. Beaches located in the northeast portion of the park have much less lithological variety, each one being formed from the erosion of local rocks.

Beaches are much longer in the inner or landward zone while those in the seaward portion are restricted to sheltered bays and small coves. Most of the shingle beaches of the seaward zone are composed of rounded material while sheltered beaches are made of very angular fragments.

Tombolos occur within Terra Nova National Park. The two best examples are at Platter's Beach in Clode Sound and at the Eastport Causeway in Southwest Arm. In both cases, there is a large supply of glacial drift available to the waves for the construction of the tombolos.

Spits observed in Terra Nova National Park are very akin to barachois. Often built at the mouth of a stream, such as at Cobbler's Brook, deltaic sediments may accumulate in an elongated ridge oblique to the shore. Other spits such as those occurring on the Big Brook flats, lie parallel to the long axis of Inner Newman Sound and the general inflow-outflow pattern of the tide.

Big Brook, Salton's Brook and Southwest Brook are three important streams that flow through glacio-fluvial outwash deposits prior to reaching the sea. Where they form deltas, estuarine conditions prevail over their flats. Big Brook river flat is located at the inner end of Newman Sound, while Salton's Brook is a small estuary located in a marine indentation made in sand and gravel. Southwest Arm delta is formed in two parts with deltaic sedimentation occurring inside the spit at the inner end of Southwest Arm and with shallow waters and visible sand banks at low tide indicating deltaic sedimentation just outside the spit.

Tidal Pools and Littoral Drift: Tidal pools in Terra Nova National Park, scattered intermittently along the intertidal range of the shoreline, express two distinct origins. First, a sill, which at low tide isolates the pool from the sea, and may aid in the accumulation of ice rafted boulders. Secondly, in the inner reaches of Clode Sound by the northeastward movement of sediments due to longshore drift.

Terra Nova's tidal pools are characteristically almost flat with very gentle concave surfaces that retain less than 1 metre of salt water at low tide and have a mean area of approximately 0.5 ha. Tidal pools occur at South Broad Cove, North Broad Cove and Minchin Head in Newman Sound and at Field Harbour near Oldfords Islands. The origin of these pools depends on the rock topography along the littoral zone, but many pools seem to be former abrasion surfaces. The concentration of ice-rafted boulders on the sills has not been explained adequately.

Between the southern entrance of the park and Platter Cove are some indices of a longshore drift in the northeastern direction which causes movement of particles parallel to the shoreline. Results of this drift can be seen at Cobbler's Brook where spits have been formed, aligned parallel to the shore, indicating that the deltaic sediments of these brooks, instead of settling directly at their mouth, are moved according to the direction of the longshore drift.

Finally, the beach at Platter Cove is the site of accumulation of a large quantity of debris including shells, dead algae, and fish which concentrate and form a cover on the beach. Very often, this organic debris is interstratified with beach sand which also accumulates.

Raised Shoreline Landforms and Evidence of Actual Uplifting Along the Shore: The altitude of the glacio-fluvial deltas of Big Brook, Salton's Brook and Southwest Arm implies that the sea level reached at least the present 30-40 metre contour line during deglaciation of the area. This marine transgression occurred when the continent was depressed under the weight of the ice cap. Following deglaciation, the continent, liberated of the excess weight of the ice, started to rebound, inducing emergence of areas inundated by the sea. Erosional and depositional shoreline forms, now at some elevation above present sea level, give evidence of a recent uplift. Raised beaches occur at several sites in Terra Nova National Park including Burnt Point, Buckley's Cove and close to some stream mouths in Southwest Arm. At most of these sites the streams have gullied the terraces and the sediments eroded in this way are deposited at the present sea level into deltaic forms. There is also a raised barachois near the mouth of Wing's Brook in Southwest Arm.

Some notches in cliffs, above sea level, mark the uplift along the shoreline. The cliff at East Point of Swale Island, raised about 10 m above actual mean sea level, is grooved by a spectacular notch carved in green sandstone. In other places, wave-cut benches, forming steps at the base of cliffs, indicate that post-glacial emergence was not constant. In fact, there were periods when the rate of uplift was equal to rising sea level, thus giving time for benches to form.

Glacial drift that has been reworked by the sea occurs at a small head east of Dumpling Cove. This is an indicator of the isostatic uplift along the shoreline. Other deposits of reworked till occur at Platter's Beach. An exposure at this location shows that the surface of the glacio-fluvial sediments was reworked into a beach deposit exclusively made of granules and pebbles (Gauthier et al, 1977).

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Section VI

SOILS

The formation of a soil results from the combined action of climatological and biological factors on a parent material over a period of time. When the last glacier receded from Terra Nova National Park, some 8,000 years ago, it left behind it a desolate landscape of bedrock and surficial deposits devoid of any vegetation. In this early environment soil formation processes were already at work as they had been initiated under the influence of the freeze-thaw cycles that shatter rock into finer particles and tend to sort these particles according to size. Aggressive vegetation in its varied forms soon colonized the parent material and became more and more sophisticated as the soils stabilized and as organic matter enriched the mineral matrix. The prevailing moist, cool climate, in which precipitation exceeded evaporation, resulted in the initiation of the process of podzolization, the primary soil-forming mechanism of the park. Not all soils, however, have been developed under the influence of climate and vegetation, and other variables can be so overriding as to completely inhibit the development of a zonal soil profile. Table VI-1 summarizes the major agents that have influenced soil development in Terra Nova National Park, describes the action and indicates the resultant process or type of soil.

Table VI-1

Major Agents and Type of Action Influencing Soil Development in Terra Nova National Park

Main Agents	Action	Process or Type of Soil
Zonal factors are dominant; cool humid climate, boreal flora	oxidation and downward movement in the profile	podzolisation
Azonal factors are dominant; soils developed in water logged conditions	reduction in place	gleyification
	accumulation of organic material; peat formation	organic soils well decomposed organic material = humid peat fairly well decomposed organic material = mesic peat not decomposed organic material = fibric peat
Time; soils are too young to show any significant influence	none	regosols

Soil Classification

Soils in Terra Nova National Park have been classified according to the Canadian System of Soil Classification (Agriculture Canada, 1978). Four soil orders are represented within the park, with Podzols being predominant. The other orders present are the Organics, Gleysols and Regosols.

Podzolic soils typically occur in coarse to medium textured, acid parent materials under forest or heath vegetation in cool to very cold humid to perhumid climates. Generally, they have organic surface horizons that are commonly L, F, and H but may be Of or Om and a light-coloured eluvial horizon, Ae, which may be absent. Most podzols have a reddish brown to black B horizon with an abrupt upper boundary and lower B or BC horizons with colours progressively yellower in hue (except in reddish-coloured parent materials). Within the park, podzols are found in forty-six of the fifty-six ecosections. Humo-ferric podzols are the most common great groups being either orthic, placic or gleyed. Orthic and placic subgroups are usually found in well-drained areas, while gleyed profiles occur on moderate to imperfectly drained sites.

The Organic order of soils are those that have developed dominantly from organic deposits. The majority of organic soils are saturated for most of the year, unless artificially drained, but some of them are not usually saturated for more than a few days. They contain 17 per cent or more organic carbon, and: (1) if the surface layer consists of fibric organic material and the bulk density is less than 0.1 (with or without a mesic or humic Op less than 15 cm thick), the organic material must extend to a depth of at least 60 cm; or (2) if the surface layer consists of organic material with a bulk density of 0.1 or more, the organic material must extend to a depth of at least 40 cm; or (3) if a lithic contact occurs at a depth shallower than stated in (1) or (2) above, the organic material must extend to a depth of at least 10 cm. The Organic order of soils is the second most frequently occurring soil order in Terra Nova National Park and is found in over half of the park's ecosections. They are particularly important along the park's western boundary at Gross Bog (A-13) and Salton's Marsh (A-7). Mesisols, humisols and fibrisols are the dominant great groups with typic and terric sub-groups being most prevalent. Organic soils are found in areas where drainage is retarded or impeded and form the major soil type of bogs and fens.

The Gleysolic order of soils is developed under wet conditions and permanent or periodic reduction. These soils have low chromas, or prominent mottling, or both, in some horizons. The great groups Gleysol, Humic Gleysol, and Lithic Gleysol are included in the order. They form the major soil order in only a few of Terra Nova National Park's ecosections and are not as widespread as are the podzols and organic soils. They occur mostly in Ecodistrict A and are associated with poor to imperfectly drained areas such as those found along the edge of the park's major bogs (A-14, A-15).

The Regosolic order within the park consists of soils that form from deep, unconsolidated deposits and have no definite genetic horizons. They are immature soils which have not developed due to a number of limiting factors such as turbulence, climatic extremes, etc. Regosols are found in Terra Nova National Park in areas with fluvial plain sediments, areas with shallow till and on scree slopes. These sites vary from well drained to poorly drained and include Ecosections A-2 and A-12.

The following Table VI-2 presents the organization of the soils found in Terra Nova National Park within the framework of the Canadian System of Soil Classification.

Table VI-2

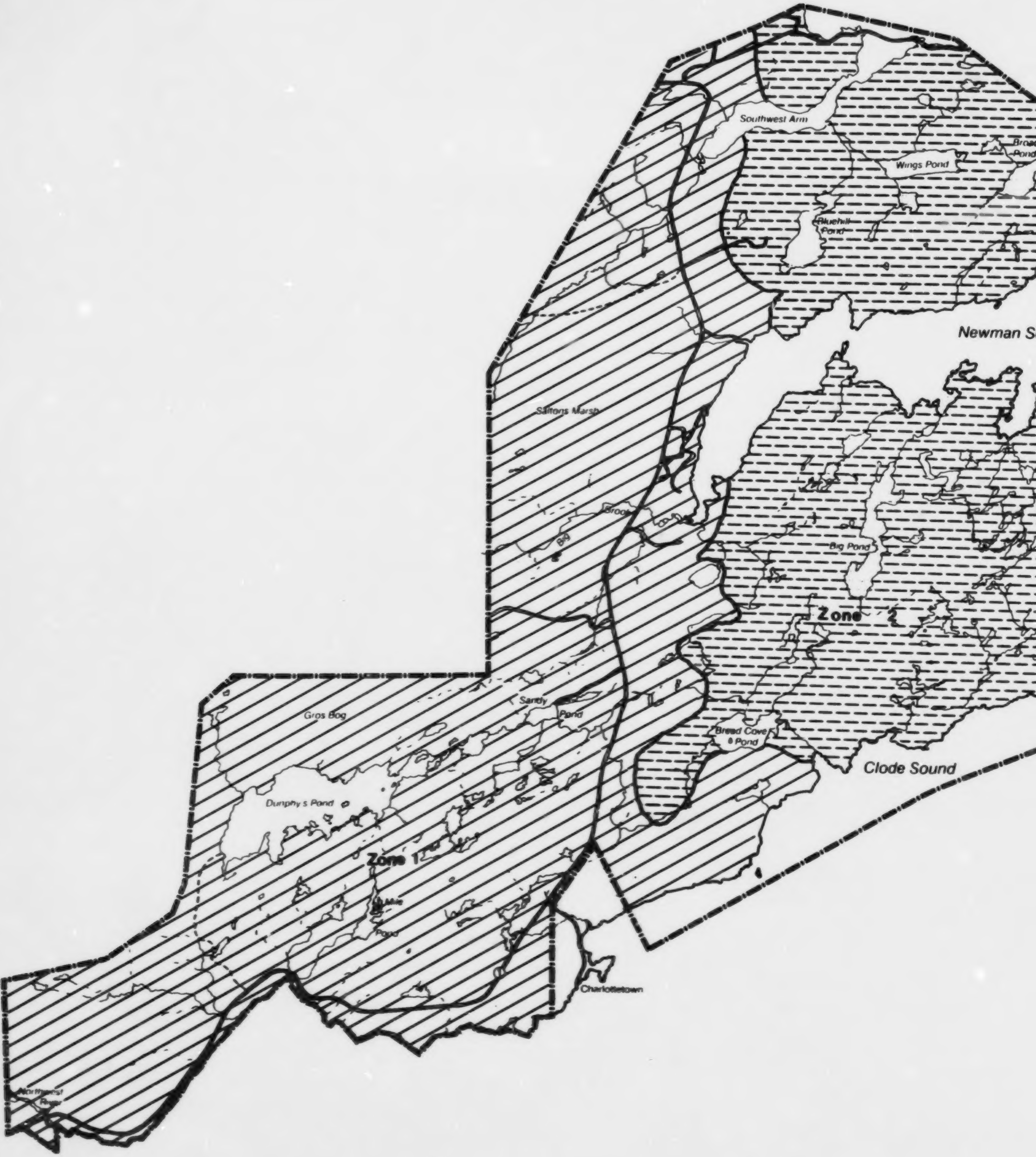
Position of the Soils of Terra Nova National Park in the Canadian Soil Classification

Order	Great Group	Sub-Group
Podzolic	humo-ferric	orthic placic gleyed placic gleyed
	(ferro-humic)	
Regosolic	regosol	orthic gleyed
Gleysolic	humic gleysol	orthic
	gleysol	orthic
Organic	fibrisol	sphagno terric
	mesisol	typic terric
	humisol	typic terric
Bedrock		

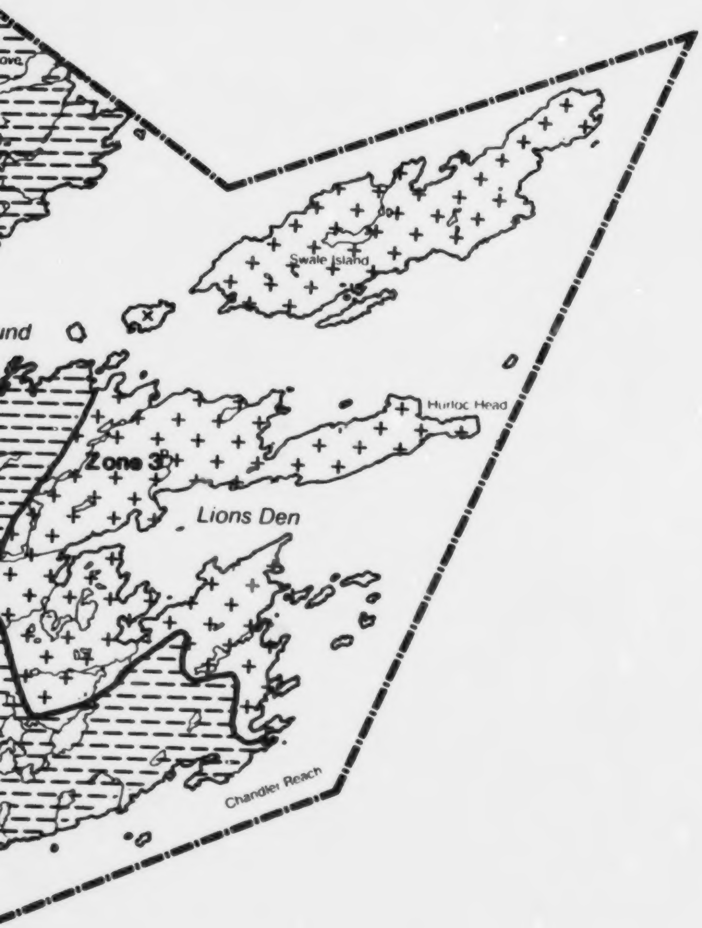
Soil Zones of Terra Nova National Park

Terra Nova National Park has three definite soil zones which are shown in Map VI-1 and are described as follows:

Zone One: Embraces the western portion of the park and is dominated by Humo-ferric podzols which have Love Cove Group and Musgravetown Group rock types as parent material.


Southwest Arm
Broa
Pond
Wings Pond
Bluehill Pond
Newman S
Saltons Marsh
Big Brook
Big Pond
Zone 2
Sandy Pond
Gros Bog
Bread Cove Pond
Clode Sound
Dunphy's Pond
Zone 1
Mile Pond
Charlottetown
Northwest River

Terra Nova National Park



und
Swale Island
Hurloc Head
Zone 3
Lions Den
Chandler Reach

MAP VI-1

Soil Zones of Terra
Nova National Park

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4
N

Areas with Musgravetown Group rock types (Ecodistrict C) tend to display orthic soil profiles whereas lithic profiles dominate over Love Cove Group parent material (Ecodistrict B).

Organic soils and gleysolic soil profiles are prevalent in areas of this zone where drainage is retarded or impeded (A-7, A-13 and C-2), while regosols occur along the valley of Big Brook (A-12) and Southwest Brook (A-2).

Muck (a mix of mineral sediments and organic debris), which is found in the area of Bread Cove Brook (C-2), is an uncommon soil type in the park.

Zone Two: Includes most of the eastern portion of the park (Ecodistrict D) and humo-ferric podzols are again the dominant soil types found, although organic soils are prevalent as well. Lithic soil profiles dominate on parent material originating from Connecting Point Group rock types (D-2), while orthic soil profiles are dominant in parent material of the Musgravetown Group rock type (D-17). The areas of lithic humo-ferric podzols are usually found on shallow till, sometimes near rock outcrops, while orthic humo-ferric podzols are usually found on thicker deposits. Where seepage increases on downslopes, there is a trend to profiles or gleyed podzols or gleysols (D-18).

Organic soils (including mesisols, humisols and fibrisols) also occur quite frequently in this zone.

Zone Three: Consists of the Lion's Den area and Swale Island (Ecodistrict E). This zone displays predominantly lithic soil profiles on parent material originating from Connecting Point Group rock types. Podzols and gleysols are the most frequently occurring soil orders (E-3), although organic soils dominate in the depressions (E-4).

Properties of Soils Found in Terra Nova National Park

Thickness: There is a gradation in soil thickness as one crosses the park from west to east. In the western part, where drumlinoid forms dominate the landscape, the soils are generally very thick with exceptions localized mainly in Ecodistrict B. Thin soils are dominant in Ecodistrict D where most of the deposits are shallow till over bedrock. In the Lion's Den area and on Swale Island, soils with complete profiles are limited to intricacies created at points of weakness in the bedrock.

Texture and Structure: The textures most common to the soils of Terra Nova National Park are sandy loam, medium sandy loam and loamy medium sand. Texture varies according to surficial material, but this variation is expressed only in special cases that are limited in area (e.g., fluvioglacial deposits where coarse sand predominates). The weathering deposits of Ecodistrict E are coarser and show a greater stone content than normal in other park areas.

As far as structure is concerned, the soil material is either single grained (structureless) or presents a weak, sub-angular, blocky-like structure with medium size aggregates.

Drainage: Factors which tend to impede soil drainage are prevalent in Terra Nova National Park and include:

(i) proximity to bedrock, a major feature of Ecodistricts D and E;

(ii) compaction of surficial material which is a characteristic of the smeared drumlinoid moraines; and

(iii) the presence of an impervious layer of iron pan found in many soil profiles (Ecosection A-21).

Areas in the park with good soil drainage are restricted to coarse surficial deposits or areas with moderately steep slopes. Well-drained soils include orthic, placic, humo-ferric podzols, as well as orthic regosols.

Imperfectly to poorly drained soils include the following: gleyed humo-ferric podzols; humic gleysols; orthic gleysols; gleyed regosols; and the organic soils.

Relation to Stand History: The build up of organic matter has a strong influence on the development of soil profiles and can even modify site conditions. In a cool, humid environment such as Terra Nova National Park, the rate of deposition of organic matter on the ground is greater than the rate of decomposition, thus causing the accumulation of a gradually thicker humus layer. The presence of shrubs such as *Kalmia angustifolia* greatly accelerates this phenomenon and can transform a site suitable for forest growth into a heathland devoid of trees.

Classification of Soils Found in Terra Nova National Park

The Canadian Soil Classification (M.A.C. 1972) defines the soil series as grouping all soils or soil profiles having in common a similar number and sequence of horizons whose colour, texture, structure, consistence, thickness, reaction and mineral composition, or any combination of these properties, vary within prescribed limits. (Gauthier et al, 1977)

The following Table VI-3 outlines Terra Nova's major soils at the series level:

Table VI-3

Soil Classification at the level corresponding to the Series

Soil Developed From	Texture	Drainage	Sub-Group
2.1 Undifferentiated till, ground moraine, lateral moraine till.	Loam to silty medium sand.	Good - found on upper convex slopes and steep uniform slopes.	Orthic Humo-Ferric Podzols or Placic Humo-Ferric Podzols.
		Moderate to moderate with seepage moderate slopes.	Orthic Humo-Ferric Podzol and Placic Humo-Ferric Podzol.
		Moderate with seepage - base of long or steep slopes.	Gleyed Humo-Ferric Podzol.
		Imperfect with or without seepage - gentle slopes, lower slopes.	Gleyed Humo-Ferric Podzol, Gleyed Placic Humo-Ferric Podzol.
		Imperfect with seepage, base of steep slope, rich.	Gleyed Humo-Ferric Podzol.
		Poor - flats, bog border, islands in bogs	Gleyed Placic Humo-Ferric Podzol, Orthic Gleysol.
		Poor with seepage, foot of steep slopes, narrow valleys.	Orthic Gleysol

Table VI-3 (Contin.)

Soil Developed From	Texture	Drainage	Sub-Group
		Poor with seepage, local depressions, running water near peat margin.	Orthic Humic Gleysol
2.2 Drumlinoid material or hummocky moraine, the second being fairly rare.	Fine to medium sand; loamy medium sand.	Rapid to good crests, knobs	Orthic Humo-Ferric Podzol.
		Good to moderate, posibily with seepage - gentle to moderate slope.	Orthic Humo-Ferric Podzol.
		Imperfect, with or without seepage - gentle to moderate slopes.	Gleyed Humo-Ferric Podzol, Gleyed Placic Humo-Ferric Podzol.
2.3 Glacio-Fluvial deposits and deltas.	Stratified sand and gravel	Rapid to good, crests or flat surfaces.	Orthic Humo-Ferric Podzol.
		Good to moderate, flat surfaces, steep slopes.	Orthic and Placic Humo-Ferric Podzol.
		Moderate to imperfect moderate slopes.	Orthic and Gleyed Humo-Ferric Podzol, Gleyed Placic Humo-Ferric Podzol.

Table VI-3 (Contin.)

Soil Developed From	Texture	Drainage	Sub-Group
2.4 Marine or lacustrine sediments.	Coarse sand and cobble	Good, flat to gently sloping.	Orthic Humo-Ferric Podzol.
		Moderate to imperfect; flat to gentle slope.	Orthic Humo-Ferric Podzol.
		Poor; flat to gentle slope.	Orthic Gleysol.
2.5 Fluvial plain sediments	Sand	Poor, with or without seepage; floodplains.	Orthic Gleysol, Gleyed Regosol, Gleyed Humo-Ferric Podzol.
2.6 Scree Slopes.	Variable	Variable; steep slopes at base of cliffs.	From Orthic Regosol to Gleyed Humo-Ferric Podzol.
2.7 Shallow till over bedrock.	Loamy medium sand.	Good; variable topography.	Humo-Ferric Podzol.
		Moderate; variable topography.	Humo-Ferric Podzol.
		Imperfect; variable topography	Gleyed Lithic Humo-Ferric Podzol.
		Floor; Depressions.	Gleyed Humo-Ferric Podzol; Lithic Gleysol.
2.8 Very shallow till, weathered material and terrains dominated by rock outcrops.	Very stony, coarse sands, few fines	Very rapid exposed till summits	Regosol.

Table VI-3 (Contin.)

Soil Developed From	Texture	Drainage	Sub-Group
		Rapid to good; convey slopes.	Humo-Ferric Podzol.
		Variable, rapid to imperfect; rolling topography.	Humo-Ferric Podzol, Gleyed Humo-Ferric Podzol.
		Imperfect to poor, concave slopes.	Gleyed Humo-Ferric Podzol, Lithic Gleysol.
2.9 Bedrock		Excessive	These soils consist of a thin Humus layer overlying bedrock; rock outcrops are not included.
2.10 Organic deposits		Very poor with or without seepage.	Very shallow, well decomposed peat in local depressions.
		Complex of deep Fibric peat; flat or raised bogs - Sphagno-Fibrisol.	
	Complex of moderately deep Fibric and Mesic peat.		Sphagno-Fibrisol Terric Fibrisol Typic Mesisol
	Complex of deep rarely shallow Humic and Mesic peat.		Typic Humisol Typic Mesisol Lithic Humisol

Table VI-3 (Contin.)

Soil Developed From	Texture	Drainage	Sub-Group
	Complex of deep to moderately deep Humic and Mesic peat.		Typic Mesisol Terric Mesisol Typic Humisol Terric Humisol
	Complex of very shallow Humic and Mesic peat.		Terric Mesisol Terric Humisol
	Moderately deep, very well decomposed peat - periodically flooded areas.		Typic Humisol Terric Humisol
	Mixture of sand and organic matter influenced by Fluvial and tidal currents.		
2.11 Bare Bedrock.			

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SECTION VII

FLORA

To the casual observer, the vegetation of Terra Nova National Park appears very uniform and possibly monotonous. While only a few elements of the boreal flora occur in the park, they combine into many associations, thus showing their great adaptability to various site conditions.

Vegetation Zones

Three broad vegetation zones may be considered to exist within the park. The first comprises the entire area west of the Trans-Canada Highway, extending up to a series of hills (Malady Head, Blue Hill, Ochre Hill, etc.) dividing the park from north to south. In this area, dense balsam fir and black spruce stands colonizing thick deposits, alternate according to site, stand history and competition. Hylocomium-balsam fir, black spruce-moss, and Kalmia-black spruce are the three forest types dominating the landscape.

The second vegetation zone lies east of the Trans-Canada Highway and is characterized by shallow till with pockets of deeper material colonized by open black spruce stands with a dense understory of shrubs. Dense stands of balsam fir and black spruce are still present, but only in limited areas.

The third zone lies in the eastern most portion of the park extending mainly over Swale Island and the area around Lion's Den. Here, rock outcrops are the dominant feature of the landscape and the vegetation grows on weathered material presenting a pattern that reflects the structure of the bedrock.

Vegetation Sample Plots and Vascular Plant List

In 1980, permanent sample plots were established for the purpose of monitoring vegetation within the park. Figure VII-1 shows the occurrence of vegetation components expressed as a percentage of the total number of study plots established.

As part of the park's Biophysical Inventory, carried out in the mid 1970's, a collection of vascular plants was made. A checklist of these plants is provided in Table VII-1 with plant names given in English, Latin and French.

Forest Vegetation

Terra Nova National Park is situated in the northern portion of the Avalon Section of the Boreal Forest Region of Canada (Rowe, 1972). Forests cover approximately 70 per cent of the park's land area with wetland and barrens comprising most of the remainder (Gauthier et al, 1977). Forest cover is dominated by coniferous species, mainly balsam fir (Abies balsamea) and black spruce (Picea mariana). White birch (Betula papyrifera) is generally scattered in the coniferous stands and locally forms mixed or even pure stands. Trembling aspen (Populus tremuloides) can be found in small patches or dispersed in mixed stands. Individual specimens of red maple (Acer rubrum) occupy rich sites while larch (Larix laricina) is found mixed with black spruce on wetland sites or forms linear, very open stands on wet sites along brooks.

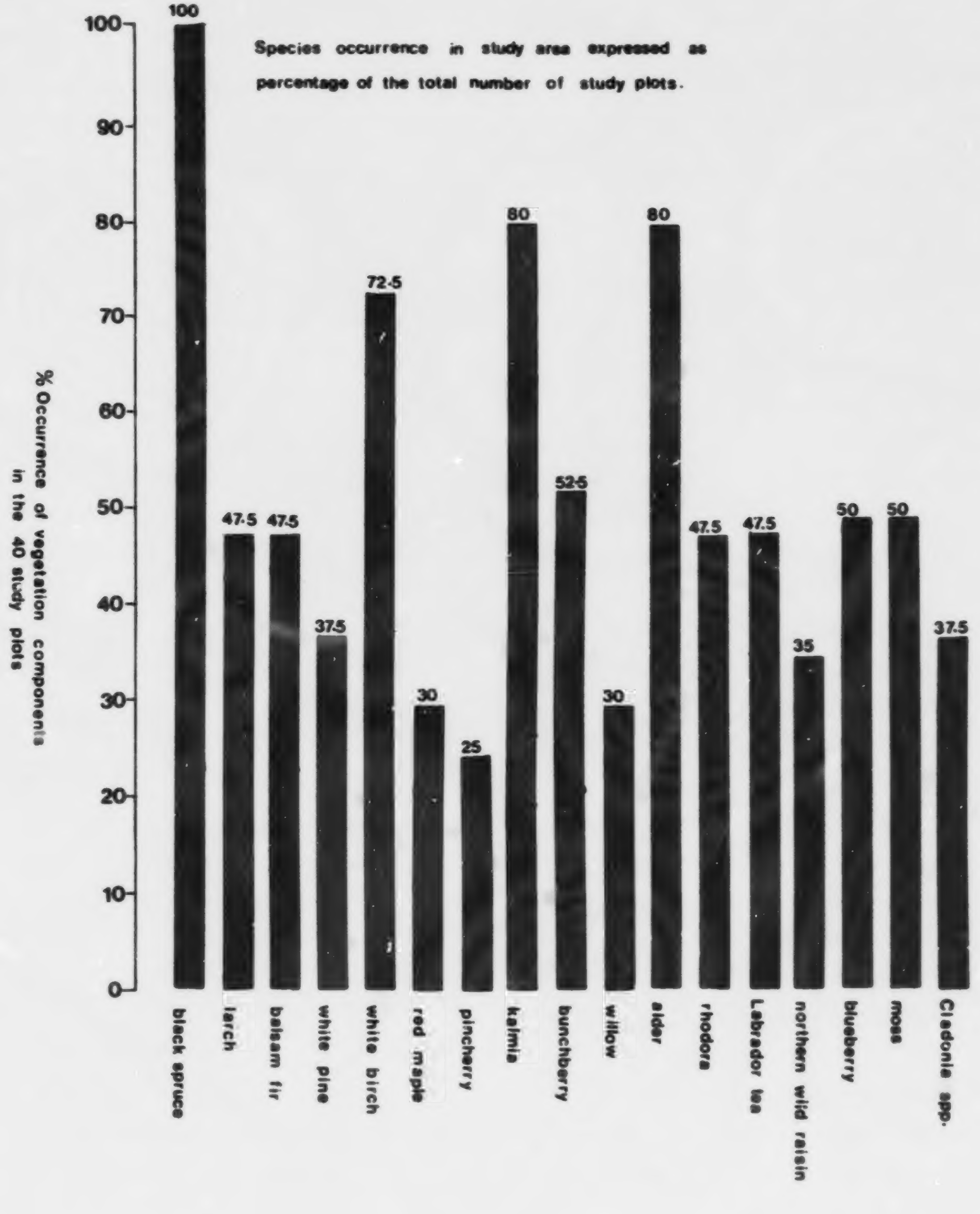

Species occurrence in study area expressed as percentage of the total number of study plots.
% Occurrence of vegetation components in the 40 study plots
100
90
80
70
60
50
40
30
20
10
0
100
47.5
47.5
37.5
72.5
30
25
80
52.5
30
80
47.5
47.5
35
50
50
37.5
black spruce
larch
balsam fir
white pine
white birch
red maple
pincherry
kalmia
bunchberry
willow
alder
rhodora
Labrador tea
northern wild raisin
blueberry
moss
Cladonia spp.

FIGURE VII-1

Table VII-1

Checklist of The Vascular Plants of Terra Nova National Park

English name	Scientific name	French name
LYCOPODIACEAE		
Stiff Clubmoss	*Lycopodium annotinum*	Lycopode innovant
Common Clubmoss	*Lycopodium clavatum*	Lycopode claviforme
Flattened Clubmoss	*Lycopodium complanatum*	Lycopode aplati
Fanshaped Clubmoss	*Lycopodium flabelliforme*	Lycopode en éventail
Bog Clubmoss	*Lycopodium inundatum*	Lycopode palustre
Shining Clubmoss	*Lycopodium lucidulum*	Lycopode brillant
Ground Pine	*Lycopodium obscurum*	Lycopode foncé
Fir Clubmoss	*Lycopodium selago*	
EQUISITACEAE		
Field Horsetail	*Equisetum arvense*	Prêle des champs
Wood Horsetail	*Equisetum sylvaticum*	Prêle des bois
OSMUNDACEAE		
Cinnamon Fern	*Osmunda cinnamomea*	Osmonde cannelle
Interrupted Fern	*Osmunda claytonia*	Osmonde de Clayton
Royal Fern	*Osmunda regalis*	Osmonde royale
SCHIZAEACEAE		
Curly Grass Fern	*Schizaea pusilla*	
POLYPODIACEAE		
Lady Fern	*Athyrium filix-femina*	Athyrium fougère-femelle
Crested Shield-fern	*Dryopteris cristata*	Dryoptéride accretée
Oak Fern	*Dryopteris disjuncta*	Dryoptéride disjointe

Table VII-1 (Contin.)

English name	Scientific name	French name
PLOYPODIACEAE cont'd		
Fragrant Shield-fern	Dryopteris fragrans	Dryoptéride fragrante
New York Fern	Dryopteris noveboracensis	Dryoptéride de New York
Long Beech Fern	Dryopteris phegopteris	Dryoptéride de Hêtre
Spinulose Wood-fern	Dryopteris spinulosa	Dryoptéride spinuleuse
Sensitive Fern	Onoclea sensibilis	Onoclée sensible
Polypod Fern	Polypodium virginianun	Polypode de Virginie
Bracken Fern	Pteridium aquilinum	Ptéridium des aigles
Alpine Woodsia Fern	Woodisa alpina	Woodsia alpine
TAXACEAE		
Yew or Ground Hemlock	Taxus canadensis	If du Canada
PINACEAE		
Balsam Fir	Abies balsamea	Sapin baumier
Common Juniper	Juniperus communis	Genévrier commun
Trailing Juniper	Juniperus horizontalis	Genévrier horizontal
Larch or Tamarack	Barix Laricina	Méléze laricin
White Spruce	Picea glauca	Épinette blanche
Black Spruce	Picea mariana	Épinette noire
White Pine	Pinus strobus	Pin blanc
TYPHACEAE		
Cat-tail	Typha latifolia	quenouille à feuilles
SPARGANIACEAE		
American Bur-reed	Sparganium americanum	Rubanier d'Amérique
Narrowleaved Bur-reed	Sparganium angustifolium	Rubanier à feuilles étroit
Green Bur-reed	Sparganium chlorocarpon	Rubanier à fruits verts

Table VII-1 (Contin.)

English name	Scientific name	French name
SPARGANIACEAE cont'd		
Floating Bur-reed	Sparganium fluctans	Rubanier flottant
Northern Bur-reed	Sparganium hyperboreum	Rubanier hyperboréal
Small Bur-reed	Sparganium minimum	Rubanier noir
ZOSTERACEAE		
Grassy Pondweed	Potamogeton gramineus	Potamot graminoide
Eelgrass	Zostera marina	Zostère marine
JUNCAGINACEAE		
Gaspé Arrowgrass	Triglochin gaspense	Troscart de la Gaspésie
Seaside Arrowgrass	Triglochin maritima	Troscart maritime
Marsh Arrowgrass	Triglochin palustris	Troscart des marais
POACEAE OR GRAMINEAE		
Slender Wheatgrass	Agropyron trachycaulum	Agropyron a chaumes rudes
Redtop	Agrostis alba	Agrostide blanche
Twin Bentgrass	Agrostis geminata	
Ticklegrass	Agrostis scabra	Agrostide scabre
Colonial Bentgrass	Agrostis tenuis	Agrostide tenue
Sweet Vernal-grass	Anthoxanthum odoratum	Flouve adorante
Shortplume Grass	Brachyelytrum erectum	Brachyelytrum dressé
Fringed Brome-grass	Bromus ciliatus	Brome cilié
Blue joint	Calamogrostis canadensis	Foin bleu
Northern Reedgrass	Calamogrostis inexpansa	Calamagrostis contracté
Pickering's Reedgrass	Calamagrostis pickeringii	Calamagrostis de Pickering
Drooping Wood-reed	Cinna latifolia	Cinna a larges feuilles
Strand Wheat	Elymus arenarius	Seigle de mer

Table VII-1 (Contin.)

English name	Scientific name	French name
POACEAE OR GRAMINEAE cont'd		
Beach Rye	Elymus mollis	Seigle de mer molle
Fescue-grass	Festuca rubra	Fétuque rouge
Northern Mannagrass	Glyceria borealis	Glycérie boréale
Rattlesnake Mannagrass	Glyceria canadensis	Glycérie du Canada
American Mannagrass	Glyceria grandis	Glycérie géante
Nerved Mannagrass	Glyceria striata	Glycérie striée
Velvet Grass	Holcus lanatus	Houlque laineuse
Timothy-grass	Phleum pratense	Phléole des prés
Alpine Blue-grass	Poa alpina	Pâturin alpin
Grove Meadowgrass	Poa alsodes	Pâturin des bosquets
Canada Blue-grass	Poa compressa	Pâturin comprimé
Fowl Blue-grass	Poa palustris	Pâturin palustre
Kentucky Blue-grass	Poa pratensis	Pâturin des prés
Poor Goosegrass	Puccinellia paupercula	Puccinellie maigre
Smooth Cordgrass	Spartina alternifolia	Spartine alterniflore
Saltmeadow Cordgrass	Spartina patens	Spartine étalée
Prairie Cordgrass	Spartina pectinata	Spartine pectinée
CYPERACEAE		
Burnt Sedge	Carex adusta	Carex brulé
Copper Sedge	Carex aenea	Carex cuivré
Narrow Sedge	Carex angustior	Carex étroit
Bear Sedge	Carex arctata	Carex dru
Bebb's Sedge	Carex bebbii	Carex de Bebb
Brownish Sedge	Carex brunnescens	Carex brunatre
Buxbaum's Sedge	Carex Buxbaumii	Carex de Buxbaum
Silvery Sedge	Carex cannescens	Carex blanchâtre
Chestnut Sedge	Carex castanea	Carex chatain

Table VII-1 (Contin.)

English name	Scientific name	French name
CYPERACEAE cont'd		
Largeheaded Sedge	Carex cephalantha	Carex en tête
Crawford's Sedge	Carex crawfordii	Carex de Crawford
Fringed Sedge	Carex crinita	Carex crépu
Weak Sedge	Carex debilis	Carex faible
Dewey's Sedge	Carex deweyana	Carex de Dewey
Diandrous Sedge	Carex diandra	Carex diandre
Two-seeded Sedge	Carex disperma	Carex disperme
Meagre Sedge	Carex exilis	Carex maigre
Yellow Sedge	Carex flava	Carex jaune
Folliculate Sedge	Carex folliculata	Carex folliculé
Moniliform Sedge	Carex hormathodes	Carex moniliformé
Houghton's Sedge	Carex houghtonii	Carex de Houghton
Inland Sedge	Carex interior	Carex continental
Bladder Sedge	Carex intumescens	Carex gonflé
Villose Sedge	Carex lasiocarpa	Carex a fruits tomenteux
Lenticular Sedge	Carex lenticularis	Carex lenticulaire
Bristle-stalked Sedge	Carex leptalea	Carex a tiges grêles
Finely-nerved Sedge	Carex leptonervia	Carex leptonervé
Livid Sedge	Carex livida	Carex livide
Michaux's Sedge	Carex michauxiana	Carex de Michaux
Rhacheoled Sedge	Carex microglochin	Carex a petite arête
Black Sedge	Carex nigra	Carex noir
Few-seeded Sedge	Carex oligosperma	Carex oligosperme
Scaly Sedge	Carex paleacea	Carex paleacé
Pale Sedge	Carex pallescens	Carex pâle
Few-flowered Sedge	Carex pauciflora	Carex pauciflore
Stunted Sedge	Carex paupercula	Carex chétif
Spreading Sedge	Carex projecta	Carex à bec étalé
Beaked Sedge	Carex rostrata	Carex rostré

Table VII-1 (Contin.)

English name	Scientific name	French name
CYPERACEAE cont'd		
Saltmarsh Sedge	Carex salina	Carex salin
Stone Sedge	Carex saxatilis	Carex miliaire
Sciroid Sedge	Carex scirpoidea	Carex faux-scirpé
Broom Sedge	Carex scoparia	Carex a balais
Sand Sedge	Carex silicea	Carex silicicole
Sterile Sedge	Carex sterilis	Carex sterile
Stipitate Sedge	Carex stipata	Carex stipité
Styled Sedge	Carex stylosa	
Threefruited Sedge	Carex trisperma	Carex trispermé
Greenish Sedge	Carex viridula	Carex verdâtre
Fox Sedge	Carex vulpincidae	Carex faux-vulpin
Wiegand's Sedge	Carex wiegandii	Carex de Wiegand
Threeway Sedge	Dulichium arundinaceum	Dulichium roseau
Needle Spike-rush	Eleocharis acicularis	Eléocharide aciculaire
Salt Spike-rush	Eleocharis halophila	
Low Spike-rush	Eleocharis parvula	Eléocharide naine
Ovate Spike-rush	Eleocharis ovata	Eléocharide ovale
Small's Spike-rush	Eleocharis smallii	Eléocharide de Small
Slender Spike-rush	Eleocharis tenuis	Eléocharide tenue
Single-scaled Spike-rush	Eleocharis uniglumus	Eléocharide uniglume
Narrowleaved Cottongrass	Eriophorum angustifolium	Linaigrette a feuilles étroites
Hare's Tail	Eriophorum spissum	Linaigrette dense
Delicate Cottongrass	Eriophorum tenellum	Linaigrette ténue
Tawny Cottongrass	Eriophorum virginicum	Linaigrette de Virginie
Green-keeled Cottongrass	Eriophorum viridi-carinatum	Linaigrette verte

Table VII-1 (Contin.)

English name	Scientific name	French name
CYPERACEAE cont'd		
White Beak-rush	Rhynchospora alba	Rhynchospore blanc
Brown Beak-rush	Rhynchospora fusca	Rhynchospore brun
Three-square Rush	Scirpus americanus	Scirpe d'Amérique
Blackgirded Woolgrass	Scirpus atrocinctus	Scirpe a ceinture noire
Tufted Club-rush	Spirpus cespitosus	Scirpe gazonnant
Redsheathed Bullrush	Spirpus rubrotinctus	Scirpe a gaines rouges
Swaying Rush	Scirpus subterminalis	Scirpe subterminal
JUNCACEAE		
Jointed Grass	Juncus articulatus	Jonc articulé
Baltic Rush	Juncus balticus	Jonc de la Baltique
Short-tailed Rush	Juncus brevicaudatus	Jonc brevicaudé
Toad Rush	Juncus bufonius	Jonc des crapauds
Canada Rush	Juncus canadensis	Jonc du Canada
Dudley's Rush	Juncus dudleyii	Jonc de Dudley
Soft Rush	Juncus effusus	Jonc épars
Thread Rush	Juncus filiformis	Jonc filiforme
Black Grass	Juncus gerardii	Jonc de Gerard
Mud Rush	Juncus pelocarpus	Jonc a fruits bruns
	Juncus subcaudatus	
Slender Rush	Juncus tenuis	Jonc ténu
Meadow Wood-rush	Luzula campestris	Luzule champêtre
Many-flowered Wood-rush	Luzula multiflora	Luzule multiflore
LILIACEAE		
Corn Lily	Clintonia borealis	Clintonie boréale
Wild Lily-of-the-valley	Maianthemum canadense	Maiantheme du Canada

Table VII-1 (Contin.)

English name	Scientific name	French name
Starry False Solomon's Seal	Smilacina stellata	Smilacine étoillée
Threeleaved False Solomon's Seal	Smilacina trifolia	Smilacine trifoliée
Twisted Stalk	Streptosus amplexifolius	Streptope amplexicaule
Rose Twisted Stalk	Streptosus roseus	Streptope rose
Nodding Trillium	Trillium cernuum	Trille penché
IRIDACEAE		
Hooker's Iris	Iris hookerii	Iris de Hooker
Blue Flag Iris	Iris versicolor	Iris versicolore
Blue-eyed Grass	Sisyrinchium angustifolium	Bermudienne à feuilles étroites
Mountain Blue-eyed Grass	Sisyrinchium montanum	Bermudienne montagnarde
ORCHIDACEAE		
Dragon's Mouth	Arethusa bulbosa	Aréthuse bulbeuse
Grass Pink	Calopogon pulchellus	Calopogon gracieux
Spotted Coral-root	Corallorhiza maculata	Corallorhize maculé
Mocassin Flower	Cypripedium acaule	Cypripède acaule
Creeping Rattlesnake Plantain Orchid	Goodyera repens	Goodyérie rampante
Green Club-spur Orchid	Habenaria clavellata	Habénaire claviforme
Bog Candle	Habenaria dilatata	Habénaire dilatée
One-leaf Rein Orchis	Habenaria obtusata	Habénaire à feuille obtuse
Large Roundleaf Orchis	Habenaria orbiculata	Habénaire à feuilles orbiculaires
Ragged Fringed Orchid	Habenaria lacera	Habénaire lacérée

Table VII-1 (Contin.)

English name	Scientific name	French name
ORCHIDACEAE cont'd		
Small Purple Fringed Orchid	Habenaria psycodes	Habénaire papillon
Roundleaved Orchis	Orchis rotundifolia	Orchis à feuille ronde
Nodding Ladies-tresses	Spiranthes cernua	Spiranthe penchée
Hooded Ladies-tresses	Spiranthes romanzoffiana	Spiranthe de Romanzoff
Broadleaved Twayblade	Listera convallaroides	Listère faux-muquet
Heartleaved Twayblade	Listera cordata	Listère cordée
SALICACEAE		
Trembling Aspen	Populus tremuloides	Peuplier faux-tremble
White Willow	Salix alba	Saule blanche
Bebb's Willow	Salix bebbiana	Saule de Bebb
Heartleaved Willow	Salix cordifolia	Saule a feuilles de coeur
Pussy Willow	Salix discolor	Saule discolore
	Salix glauca	
Upland Willow	Salix humilis	Saule humble
Broadleaf Willow	Salix glaucophylloides	Saule a phyllode blanche
Basket Willow	Salix purpurea	Saule pourprée
MYRICACEAE		
Sweet Gale	Myrica gale	Myrique baumier
Bayberry	Myrica pensylvanica	Myrique de Pennsylvanie

Table VII-1 (Contin.)

English name	Scientific name	French name
BETULACEAE		
Mountain Alder	Alnus crispa	Aulne crispé
Speckled Alder	alnus rugosa	Aulne rugueux
Newfoundland Dwarf Birch	Betula michauxii	Bouleau de Michaux
Canoe or White Birch	Betula papyrifera	Bouleau blanc
Swamp Birch	Betula pumila	Bouleau nain
Beaked Hazelnut	Corylus cornuta	Noisetier a long bec
URTICACEAE		
Burning Nettle	Urtica urens	Ortie
SANTALACEAE		
Northern Comandra	Geocaulon lividum	Comandre livide
LORANTHRACEAE		
Dwarf Mistletoe	Arceuthobium pusillum	arceuthobie naine
POLYGONACEAE		
Prostrate Knotweed	Ploygonum aviculare	Renouée des oiseaux
Lady's Thumb	Polygonum persicaria	Renouée persicaire
Garden Sorrel	Rumex acetosa	Rumex oseille
Sheep Sorrel	Rumex acetosella	Rumex petit-oseille
Water Dock	Rumex orbiculatus	Rumex orbiculaire
CHENOPODIACEAE		
Lamb's Quarters	Chenopodium album	Chénopode blanc
Glasswort	Salicornia europaea	Salicorne d'Europe

Table VII-1 (Contin.)

English name	Scientific name	French name
CARYOPHYLLIACEAE		
Meadow Chickweed	Cerastium arvense	Céraiste des champs
Mouse-ear Chickweed	Cerastium vulgatum	Céraiste vulgaire
Wild Pink	Dianthus armeria	Oeillet armérie
Red Campion	Lychnis dioica	Lychnis rouge
Birdseye Pearlwort	Sagina procumbens	Sagine couchée
Canadian Sand Spurry	Spergularia canadensis	Spergulaire du Canada
Purple Sand Spurry	Spergularia rubra	Spergulaire rouge
Bladder Campion	Silene cucubalus	Silene cucubale
Lesser Stitchwort	Stellaria graminea	Stellaire graminoide
Common Chickweed	Stellaria media	Stellaire moyenne
NYMPHAECEAE		
Bullhead Lily	Nuphar variegatum	Nénuphar a fleurs panachées
Fragrant Waterlily	Nymphaea odorata	Nymphéa odorant
RANUNCULACEAE		
Marsh Marigold	Caltha palustris	Populage des marais
Goldthread	Coptis groenlandica	Coptide du Groenland
Common Buttercup	Ranunculus acris	Renoncule âcre
Seaside Buttercup	Ranunculus cymbalaria	Renoncule cymbalaire
Creeping Crowfoot	Ranunculus repens	Renoncule rampante
Creeping Spearwort	Ranunculus reptans	Renoncule rampante
Tall Meadow Rue	Thalictrum polygamum	Pigamon pubescent
FUMARIACEAE		
Pale Corydalis	Corydalis sempervirens	Corydalis toujours verte

Table VII-1 (Contin.)

English name	Scientific name	French name
CRUCIFERAE OR BRASSICACEAE		
Wintercress	Barbarea vulgaris	Cresson de terre
Black Mustard	Brassica nigra	Moutarde noire
Sea Rocket	Cakile edentula	Caquillier édentulé
Shepherd's Purse	Capsella bursa-pastoris	Capselle bourse-à-pasteur
Threefingered Scurvygrass	Cochlearia tridactylites	
Dyer's Woad	Isatis tinctoria	
Field Pennycress	Thlapsi arvense	Thlapsi des champs
SARRACENIACEAE		
Pitcher Plant	Sarracenia purpurea	Sarracenie pourprée
DROSERACEAE		
Spatulate-leaved Sundew	Drosera intermedia	Rossolis intermédiare
Roundleaved Sundew	Drosera rotundifolia	Rossolis à feuilles rondes
CRASSULACEAE		
Roseroot or Stonecrop	Sedum rosea	Orpin âcre
SAXIFRAGACEAE		
Naked Miterwort	Mitella nuda	Mitrelle nue
Skunk Currant	Ribes glandulosum	Gadellier gladuleux
Smooth Gooseberry	Ribes hirtellum	Grosellier hérissé
Bristly Black Currant	Ribes lacustre	Gadellier lacustre

Table VII-1 (Contin.)

English name	Scientific name	French name
ROSACEAE		
Mountain Juneberry	Amelanchier bartramia	Amélanchier boréal
Smooth Serviceberry	Amelanchier laevis	Amélanchier glabre
Roundleaved Serviceberry	Amelanchier sanguinea	Amélanchier sanguin
Purple Chokeberry	Aronia prunifolia	Aronie a feuille de prunier
Common Strawberry	Fragaria virginiana	Fraisier de Virginie
Largeleaved Avens	Geum macrophyllum	Benoîte a grandes feuilles
Water Avens	Geum rivale	Bonîte des ruisseaux
Silverweed	Potentilla anserina	Potentille ansérine
Shrubby Cinquefoil	Potentilla fruticosa	Potentille frutescente
Rough Cinquefoil	Potentilla norvegica	Potentille de Norvege
Threetoothed Cinquefoil	Potentilla tridentata	Potentille tridentée
Pin Cherry	Prunus pensylvanica	Cérisier de Pennsylvanie
Choke Cherry	Prunus virginiana	Cérisier a fruits noirs
Northeastern Rose	Rosa nitida	Rosier brillant
Virginian Rose	Rosa virginiana	Rosier de Virginie
Arctic Plumboy	Rubus arcticus	Ronce acaule
Smooth Blackberry	Rubus canadensis	Ronce du Canada
Bakeapple or Cloudberry	Rubus chamaemorus	Ronce petit-mûrier
Neat Blackberry	Rubus elegantulus	Ronce élégante
Red Raspberry	Rubus idaeus	Ronce de mont
Pennsylvanian Blackberry	Rubus pensylvanicus	Ronce de pennsylvanie
Dewberry	Rubus pubescens	Ronce pubescente
Canadian Burnet	Sanguisorba canadensis	Sanguisorbe du Canada
American Mountain Ash	Sorbus americana	Sorbier d'Amérique

Table VII-1 (Contin.)

English name	Scientific name	French name
ROSACEAE cont'd		
Showy Mountain Ash	Sorbus decora	Sorbier de montagne
Meadowsweet	Spiraea latifolia	Spirée a larges feuilles
LEGUMINOSAE OR FABACEAE		
Beach Pea	Lathyrus japonicus	Gesse maritime
Vetchling	Lathyrus palustris	Gesse palustre
Hop Clover	Trifolium agrarium	Tréfle jaune
Alsike Clover	Trifolium hybridum	Tréfle hybride
Red Clover	Trifolium pratense	Tréfle rouge
Small Hop Clover	Trifolium procumbrens	Tréfle couché
White Clover	Trifolium repens	Tréfle blanc
Cow Vetch	Vicia cracca	Vesce jargeau
GERANIACEAE		
Bicknell's Cranesbill	Geranium bicknellii	Geranium de Bicknell
Meadow Cranesbill	Geranium pratense	Geranium des prés
CALLITRICHACEAE		
Water Starwort	Callitriche heterophylla	Callitriche hétérophylle
AQUIFOLIACEAE		
Winterberry	Ilex verticillata	Houx verticillé
Wild Holly	Nemopanthus mucronatus	Nemopanthe mucroné
ACERACEAE		
Red Maple	Acer rubrum	Erable rouge
Mountain Maple	Acer spicatum	Erable a epis

Table VII-1 (Contin.)

English name	Scientific name	French name
BALSAMINACEAE		
Spotted Touch-me-not	*Impatiens capensis*	Impatiente du Cap
MALVACEAE		
Musk Mallow	*Malva moschata*	Mauve musquée
HYPERICACEAE		
Northern St. John's-wort	*Hypericum boreale*	Millepertuis boréal
Common St. John's-wort	*Hypericum perforatum*	Millepertuis commun
Marsh St. John's-wort	*Hypericum virginicum*	Millepertuis de Virginie
VIOLACEAE		
Marsh Blue Violet	*Viola cucullata*	Violette cucullé
Largeleaved Violet	*Viola incognita*	Violette méconnue
Northern White Violet	*Viola pallens*	Violette pâle
Pansy	*Viola tricolor*	Viollete tricolore
ELEAGNACEAE		
Soapberry	*Shepherdia canadensis*	Shepherdies du Canada
ONAGRACEAE		
Smaller Enchanter's Nightshade	*Circaea alpina*	Circée alpine
Fireweed	*Epilobium angustifolium*	Épilobe à feuilles etroites
Lesser Willowherb	*Epilobium glandulosum*	Épilobe glanduleux
Marsh Willowherb	*Epilobium palustre*	Épilobe palustre
Downy Willowherb	*Epilobium strictum*	Épilobe molle
Common Evening-primrose	*Oenothera biennis*	Onagre bisannuelle
Sundrops	*Oenothera perennis*	Onagre vivace

Table VII-1 (Contin.)

English name	Scientific name	French name
ASCLEPIADACEAE		
Common Milkweed	Asclepias syriaca	Asclépiade de Syrie
CORNACEAE		
Alternate-leaved Dogwood	Cornus alternifolia	Cornouiller à feuilles alternes
Bunchberry	Cornus canadensis	Cornouiller de Canada
Red Osier Dogwood	Cornus stolonifera	Cornouiller stolonifère
ARALIACEAE		
Bristly Sarsparilla	Aralia hispida	Aralie hispide
Wild Sarsparilla	Aralia nudicaulis	Aralie à tige nue
UMBELLIFERAE OR ALIACEAE		
Caraway	Carum carvi	Carvi commun
Hemlock Parsley	Conioselinum chinense	Conioselinum de Genesée
Sea Lovage	Ligusticum scoticum	Livèché écossaise
ERIOCAULACEAE		
Seven-angled Pipewort	Eriocaulon septangulare	Eriocaulon septangulaire
PYROLACEAE		
One-flowered Wintergreen	Moneses uniflora	Monésés uniflore
Pine-sap	Monotropa hypopithys	Monotrope du pin
Indian Pipe	Monotropa uniflora	Monotrope uniflore
Roundleaved Wintergreen	Pyrola rotundifolia	Pyrole à feuilles rondes

Table VII-1 (Contin.)

English name	Scientific name	French name
PYROLACEAE cont'd		
Onesided Wintergreen	Pyrola secunda	Pyrole unilaterale
Greenish Wintergreen	Pyrola virens	Pyrole â feuilles verdâtre
ERICACEAE		
Bog Rosemary	Andromeda glaucophylla	Andromede glauque
Alpine Bearberry	Arctostaphylos alpina	Arctostaphyle alpin
Bearberry	Arctostaphylos uva-ursi	Arctostaphyle raisin d'ors
Leatherleaf	Chamaedaphne calyculata	Cassandre calicule
Snowberry	Gaultheria hispidula	Chiogene hispide
Wintergreen	Gaultheria procumbens	Gaulthérie couchée
Dwarf Huckleberry	Gaylussacia dumosa	Gaylussacia
Sheep Laurel or Lambkill	Kalmia angustifolia	Crevard des moutons
Bog Laurel	Kalmia polifolia	Kalmia a feuilles d'Andromede
Labrador Tea	Ledum groenlandicum	Thé du Labrador
Rhodora	Rhododendron canadense	Rhodora
Blueberry	Vaccinium angustifolium	Airelle a feuilles etroite
Large Cranberry	Vaccinium marcrocarpon	Airelle a gros fruits
Small Cranberry	Vaccinium oxycoccus	Airelle canneberge
Bog Billberry	Vaccinium uliginosum	Airelle des marécages
Partridgeberry	Vaccinium vitis-idaea	Airelle vigne d'Ida
EMPETRACEAE		
Pink Crowberry	Glaux maritima	Glaux maritime
Starflower	Trientalis borealis	Trientale boréale

Table VII-1 (Contin.)

English name	Scientific name	French name
PLUMBAGINACEAE		
Sea Lavender	*Limonium carloinianum*	Lavande de mer
GENTIANACEAE		
Buckbean	*Menyanthes trifoliata*	Herbe â canards
CONVOLVULACEAE		
Hedge Bindweed	*Convolvulus sepium*	Liseron des haies
BORAGINACEAE		
Oysterleaf	*Mertensia maritima*	Mertensia maritime
LABIATAE OR LAMIACEAE		
Common Hemp-nettle	*Galeopsis tetrahit*	Galéopside a tige carrée
Northern Bugleweed	*Lycopus uniflorus*	Lycope uniflore
Wild Mint	*Mentha arvensis*	Menthe des champs
Heal-all	*Prunella vulgaris*	Prunelle vulgaire
Common Skullcap	*Scutellaria epilobifolia*	Scutellaire commune
Mad-dog Skullcap	*Scutellaria laterifolia*	Scutellaire lateriflore
SCROPHULARIACEAE		
Turtlehead	*Chelone glabra*	Galane glabre
American Eyebright	*Euphrasia americana*	Euphraise d'Amérique
Separated Eyebright	*Euphrasia disjuncta*	Euphraise dijointe
Butter-and-eggs	*Linaria vulgaris*	Linaire vulgaire
Swamp Lousewort	*Pedicularis palustris*	Pédiculaire des marais
Yellow Rattle	*Rhinanthus cristi-galli*	Rhinanthe crête de coq
Common Mullein	*Verbascum thapsisi*	Molene vulgaire
Common Speedwell	*Veronica officinalis*	Veronique officinale
Bird's-eye Speedwell	*Veronica persica*	Veronique de Perse

Table VII-1 (Contin.)

English name	Scientific name	French name
LENTIBULARIACEAE		
Horned Bladderwort	Utricularia cornuta	Utriculaire cornue
Flatleaved Bladderwort	Utricularia intermedia	Utriculaire intermédiare
PLANTAGINACEAE		
Rushlike Plantain	Plantago juncoides	Plantain juncoide
Common Plantain	Plantago major	Plantain majeur
Seaside Plantain	Plantago maritima	Plantain maritime
Few-flowered Plantain	Plantago oliganthos	Plantain pauciflore
RUBIACEAE		
Northern Bedstraw	Galium boreale	Gaillet boréal
Marsh Bedstraw	Galium palustre	Gaillet palustre
Small Bedstraw	Galium trifidium	Gaillet trifide
Fragrant Bedstraw	Galium triflorum	Gaillet a trois fleurs
CAPRIFOLIACEAE		
Northern Bush Honeysuckle	Diervilla lonicera	Diereville chevrefeuille
Twinflower	Linnaea borealis	Linnée boréale
Hairy Fly Honeysuckle	Lonicera villosa	Chevrefeuille velu
Red Elderberry	Sambucus pubens	Sureau pubescent
Northern Wild Raisin	Viburnum cassinoides	Viorne cassinoide
Squashberry	Viburnum edule	Viorne comestible
High Bush Cranberry	Viburnum trilobum	Viorne trilobée
CAMPANULACEAE		
Bluebell	Campanula rotendifolia	Campanule a feuilles rondes
Water Lobelia	Lobelia dortmanna	Lobélie de Dortmann

Table VII-1 (Contin.)

English name	Scientific name	French name
COMPOSITAE OR ASTERACEAE		
Common Yarrow	Achillea millefolium	Achillée millefeuille
Pearly Everlasting	Anaphalis margariticea	Anaphale marguerite
Dicca Pussytoes	Antennaria neodioica	Anténnaire néodicioée
Stinking Mayweed	Anthemis cotula	Camomille marcute
Common Burdock	Arctium minus	Bardane mineure
Leafy-bracted Aster	Aster foliaceus	Aster foliacé
Savory-leaved Aster	Aster linarifolius	Aster à feuilles de linaire
Wood White or Bog Aster	Aster nemoralis	Aster des bois
New Belgium Aster	Aster nova-belgii	Aster de la Nouvelle-Belgique
Redstemmed Aster	Aster puniceus	Aster ponceau
Roughleaved Purple Aster	Aster radula	Astre rudre
Pannicled Aster	Aster simplex	Aster simple
Flat-topped White Aster	Aster umbellatus	Aster à ombelles
Ox-eye Daisy	Chrysanthemum leucanthemum	Marguerite blanche
Chicory	Cichorium intvbus	Chicorée sauvage
Canada Thistle	Cirsium arvense	Chardon des champs
Swamp Thistle	Cirsium muticum	Chardon mutique
Annual Fleabane	Erigeron annuus	Vergerette annuelle
Rough Fleabane	Erigeron strigosus	Vergerette rude
Joe-Pye-weed	Eupatorium maculatum	Eupatoire maculée
Orange Hawkweed	Hieracium aurantiacum	Epervière rouge
Canada Hawkweed	Hieracium canadense	Epervière du Canada
Florentine King Devil	Hieracium florentinum	Epervière des Florentins

Table VII-1 (Contin.)

English name	Scientific name	French name
COMPOSITAE OR ASTERACEAE		
Smoothish Hawkweed	Hieracium floribundum	Epervière à fleurs nombreuses
King Devil	Hieracium pratense	Epervière des prés
Rough Hawkweed	Hieracium scabrum	Epervière scabre
Yellow Hawkweed	Hieracium vulgatum	Epervière vulgaire
Fall Dandelion	Leontodon autumnalis	Léontodon automnal
Pineapple-weed	Matricaria matricoides	Matricaire odorante
Gall-of-the-earth	Prenanthes trifoliata	Prenanthe trifoliée
Blackeye Susan	Rudbeckia serotina	Marguerite jaune
Golden Ragwort	Senecio aureus	Sénecon doré
Sea-beach Senecio	Senecio pseudo-arnica	Sénecon faux-arnica
Stinking Groundsel	Senecio viscosus	Sénecon visqueux
Common Groundsel	Senecio vulgaris	Sénecon vulgaire
Corn Sow-thistle	Sonchus arvensi	Laiteron des champs
Common Tansy	Tanacetum vulgare	Tanaisie vulgaire
Common Dandelion	Taraxacum officinale	Pissenlit officinal
Coltsfoot	Tussilago farfara	Tussilage farfar
Canada Goldenrod	Solidago canadensis	Verge d'or du Canada
Zigzag-stemmed Goldenrod	Solidago flexicaulis	Verge d'or a tige zigzaguante
Narrowleaved Goldenrod	Solidago graminifolia	Verge d'or graminifloiée
Hairy Goldenrod	Solidago hispida	Verge d'or hispide
Elegant Goldenrod	Solidago lapida	Verge d'or élégante
Largeleaved Goldenrod	Solidago macrophylla	Verge d'or a feuilles grandes
Pursh's Goldenrod	Solidago purshii	Verge d'or de Pursh
Rough Goldenrod	Solidago rugosa	Verge d'or rugueuse
Seaside Goldenrod	Solidago sempervirens	Verge d'or toujours verte
Marsh Goldenrod	Solidago uliginosa	Verge d'or des marais

Black spruce is the dominant tree species found on nearly all forested sites. It grows best on well-drained soils, however its wide ecological amplitude is evident as it forms an important component of the park's bog and fen. Black spruce is also an important species in the regeneration of the burns on glacial till soils throughout the park and is a major climax species on hilltops, upper slopes and wet sites where mature trees vary in height between 6.8 and 12.6 meters. On rock barrens and in sphagnum bog, dwarf species of black spruce over 200 years old are known to occur. Black spruce is associated with extensive Kalmia and Cladonia barrens on dry upland sites and also forms an important admixture with balsam fir. Forest fires and selective cutting of balsam fir prior to the park's opening have favoured the growth of black spruce and resulted in a higher percentage of this species than is normal in original climax stands.

Balsam fir is a major component of stands on the middle and lower slopes of the park. Moist, deep, well-drained soils with minimal groundwater seepage are favoured. By coincidence or otherwise, stands are common along the shoreline slopes of the park's coastal areas. Black spruce and white birch are nearly always associated with balsam fir and very few extensive pure stands exist. Those that do have been severely affected by spruce budworm and balsam wooly aphid infestations and regeneration ranges from minimal to almost non-existent. Balsam fir stands within Terra Nova National Park exhibit a significant degree of variation in age and structure as a result of past cutting practices. Mature trees range in height from 6.8 to 12.6 meters.

Larch, a frequently occurring species, grows primarily on lower wet seepage slopes. Normally, it is a minor component of forest stands in association with black spruce or balsam fir and is not found in pure stands.

Mature white pine are found scattered throughout the park, being more numerous in the area of Bread Cove Brook (A-19), Diamond Pond (D-12), and around the Northwest River. Although white pine numbers have been decimated by the white pine blister rust in the remainder of the Province, there is little evidence of the disease within the park. Cutting of white pine for use by local sawmills and shipbuilders prior to the park's establishment has reduced its numbers.

White birch, a common species in Terra Nova National Park, occurs frequently as an admixture with balsam fir on moist, lower slopes. Successional stands of white birch with an understory of conifer regeneration are common south of Big Brook (A-14). These stands are believed to have originated after logging activity. A burn-over (1948) near the Louil Hilis (A-1 & D-1) is abundantly regenerated with white birch, pin cherry, alder and other minor species.

Aspen is a minor component found scattered on seepage slopes within the park. Pure stands were observed on alluvial soils at two stream valley sites (Louil Hills - D-1 & Southwest Brook - A-2). Other tree species which form a minor component of Terra Nova National Park's forest vegetation include red maple, speckled alder, pin cherry, mountain ash and wild raisin. Red maple forms a minor component of forest stands to the south of Broad Cove (D-1) and occurs along the banks of many brooks including Bread Cove Brook (D-18). Thick growth of speckled alder may be found on the alluvial soils along Southwest Brook (A-2) and Bread Cove Brook upstream from Bread Cove Pond (C-1). Small pockets of alder occur in wet depressions and on lower seepage slopes throughout the park.

Forest Communities

1. Kalmia - Conifer forests are those having black spruce as the main tree species and a ground cover of dwarf shrubs dominated by sheep laurel. They include Kalmia - black spruce; cladonia - Kalmia - black spruce; lichen woodlands; and sphagnum - Kalmia - black spruce.

   Kalmia - Black spruce is a forest type common throughout the park on soils of till origin on upper slopes and ridge tops. Also, where select cutting was carried out in black spruce - moss forest prior to the establishment of the park, this type now occurs. Black spruce is the dominant tree species with white pine and larch occurring sporadically. Balsam fir is rarely present in this type. In the stands originating from select cutting, the ground is hummocky due to sheep laurel forming mounds over remnant tree trunks. Herb stratum is dominated by bunch-berry, twin flower, lichens (Cladonia), and mosses. Crown closure may vary from 25 percent to 75 percent and there is a noticeable decrease in the abundance of ericaceous shrubs with increasing crown closure.

   Cladonia - Kalmia - Black spruce is a very open forest type which may originate from fires, but the oligotrophic nutrient status and rapid drainage of the surface soil probably restrict successional change. In Terra Nova National Park, this type is restricted to well-drained soils of glacio-fluvial sand and gravel deposits and sandy till. It is also localized on out-crops. Black spruce dominates the tree layer which also consists of scattered larch and rare occurrences of white pine. Ground vegetation is comprised of an

Photo VII-1. Kalmia-Black spruce forest type representative of vegetation on well drained sites commonly developing after fire.

ericaceous dwarf shrub layer underlain by a carpet of fruticose lichens with a sparse assemblage of herbs. Lichens generally predominate over mosses on the forest floor and include several Cladonia species, particularly Cladonia alpestris. Rhodora is noticeably more abundant in this type.

Lichen Woodlands is a unique forest type localized within Terra Nova National Park occurring close to the forest line on former river deltas and only occupying the driest and most infertile sites. The most prominent tree species are black spruce and larch which are scattered throughout these open areas. Ground cover is dominated by Cladonia lichen species although shrubs such as sheep laurel are also present.

Sphagnum - Kalmia - Black spruce forest type occurs in Terra Nova National Park along bog borders where seepage is almost nil and on mineral soil islands rising out of extensive peat deposits. Stunted balsam fir, scattered larch and white pine occur in an otherwise predominantly black spruce forest. The crowns of dominant trees are wind pruned and layering is common around the base. Ericaceous dwarf shrubs form a dense layer over the hummocky ground while Sphagnum mosses dominate the forest floor.

2. Kalmia - Birch forests originate following fire. The type occurs on orthic humo-ferric podzols developed on well drained sandy parent material. Although this type is not common within the park, a large Kalmia - birch stand occurs south of Big Brook. This forest type is the park's sole deciduous tree/ericaceous shrub type. Ground vegetation is formed by an ericaceous dwarf

Photo VII-2. Sphagnum-Kalmia-black spruce type is typical of black spruce growing on saturated soils.

Photo VII-3. Kalmia-White birch forest type is park's sole deciduous tree/ ericaceous shrub type.

shrub layer dominated by sheep laurel. Herbs and club mosses are common over the forest floor. The moss layer is not continuous.

3. Balsam Fir - White birch forests include all forests in the park dominated by balsam fir as follows: Pleurozium - balsam fir; Hylocomium - balsam fir; Rubus - balsam fir; Carex - balsam fir; and Dryopteris - Lycopodium - balsam fir.

Pleurozium - Balsam fir forests are the poorest of balsam fir forests, being common in all well-drained till ecosites, but are restricted to areas where seepage is of little or no importance. Balsam fir is the major tree species present while white birch and black spruce are minor components. Although herb and shrub layers are rarely evident due to close spacing of the trees, the forest floor typically displays an unbroken moss carpet. Reproduction in these stands is prevented by intense moose browsing.

Hylocomium - Balsam fir forests are common in fire-free stands on middle and lower slopes throughout glacial till ecosites in the park. Dense balsam fir is the major component of this type, although there are scattered white birch. Herbs and shrubs occur, but do not form continuous layers. Ground vegetation is dominated by feathermoss.

Rubus - Balsam fir forest type is rare in the park due to the area's fire history. It usually occurs where there is a small brook adjacent to the Hylocomium - balsam fir forest type. They are localized in areas with nutrient rich and fine textured till soils on lower slopes influenced by seepage waters. Dense balsam fir is the major tree species present in this type along with an admixture of white birch. Ground vegetation supports a lush layer of ferns and herbs over a feather moss carpet.

Carex - Balsam fir occurs on moist lower slopes of medium quality till, normally including balsam fir with some white birch. However, within the park, most stands of this type have a high coverage of black spruce, again because of the area's fire history. These stands will gradually develop toward a dominance of balsam fir. Ground cover is dominated by a rich assortment of ferns, sedges, and herbs dividing the moss carpet into patches.

Dryopteris - Lycopodium - Balsam fir is localized on well-drained areas of loamy till soils, occurring infrequently. Dense balsam fir is the major tree species although white birch is abundant. Ground cover is characterized by an almost continuous fern layer interspersed with herbs and sedges. Wet variations of this type occur on mucky gleysols.

4. White Birch forests are dominated by trembling aspen, red maple, and white birch and are infrequent in the park. Their occurrence is limited to sites once occupied by coniferous stands that were burnt over. Slopes underlain by nutrient-rich and fine textured till soils are occupied by this forest type. It is also sometimes localized on lower slopes enriched by seepage water. Ground cover is characterized by a lush assemblage of herbs including orchids, violets, lilies and ferns while the moss layer is scattered in small patches.

Photo VII-4. Dryopteris-Lycopodium-Balsam fir type occurring on rich well-drained soils and is characterized by an almost continuous fern layer. It is a rare and localized type within the park.

Photo VII-5. White birch stand with ground flora of Aster Sp.

5. Birch Forest on Unstable Soils pioneer on sites such as talus and scree slopes. They consist of open hardwood forests with a ground layer comprised of herb and moss patches alternating with exposed soil and rocks.

6. Black Spruce - Moss forests occur on well-drained to moderately well-drained upland sites where fire has occurred. Stands are usually densely stocked and ground cover is restricted to sparse assemblage of herbs and shrubs over a moss carpet. White pine, white birch, aspen and balsam fir are occasional species. Most of these forests originated after fire and are mature to over-mature with regeneration generally inadequate.

Table VII-2 indicates the important vegetation components of forest communities in Terra Nova National Park.

Photo VII-6. Black spruce-moss type on a till, loamy, medium sand site.

Table VII-2

Important Vegetation Components of Forest Communities
Terra Nova National Park

Community	Tree Stratum	Shrub Stratum	Herb Stratum
1. Kalmia-Conifer Forests	Black Spruce	Sheep Laurel Rhodora Blueberry	Pleurozium schreberi Cladonia mitis Cladonia rangiferina Patridgeberry
Kalmia-Black Spruce	Black Spruce (White Pine, Larch, Balsam Fir)	Sheep Laurel	Dicranum scoparium Hylocomium splendens Cladonia mitis Cladonis rangiferina Sphagnum species
Cladonia-Kalmia Black Spruce	Black Spruce (White Pine, Larch)	Sheep Laurel Rhodora	Cladonia alpestris Cladonia verticellata Cladonia uncialis Cetraria islandica Dicranum spurium Dicranum flagellare Cornicularia aculeata Polytricrum piliferum Rhacomitrium lanuginosum
Lichen Woodlands	Black Spruce	Sheep Laurel	Cladonia species
Sphagnum-Kalmia-Black Spruce	Black Spruce (Larch,White Pine, Balsam Fir)	Sheep Laurel	Bunchberry Snowberry Sphagnum species Dicranum scoparium Hylocomium splendens
2. Kalmia-Birch forest	White Birch (Black Spruce, Balsam Fir, Aspen, Red Maple)	Sheep Laurel	Herb species Moss species Lycopodium species Bracken ferns
3. Balsam Fir-White Birch Forest	Balsam Fir White Birch		Dicranum majus Dicranum scoparium Dryopteris spinulosa Hylocomium splendens Pleurozium schreberi Ptilium crista-castrensis Corn Lily Wild Lily-of-the-Valley Twisted Stalk Rose-twisted stalk Twin flower Starflower Indian Pipe

Table VII-2 (Contin.)

Community	Tree Stratum	Shrub Stratum	Herb Stratum
Pleurozium Balsam Fir	Balsam Fir (White Birch, Black Spruce)		Pleurozium schreberi
Hylocomium-	Balsam Fir		Hylocomium splendens Heartleaved Twayblade Creeping Rattlesnake Plantain Orchid One-flowered Wintergreen One-sided Wintergreen Green club-spur orchid One-leaf Relid Orchid
Rubus-Balsam Fir Forest	Balsam Fir (White Birch, Black Spruce)	Mountain maple	Hylocomium umbratum Stiff Clubmoss Brachythecium salesbrosum Largeleaved Goldenrod Dewberry Largeleaved Violet Red Elderberry Goldthread Naked Miterwort Fern species
Corex-Balsam Fir Forest	Balsam Fir (White Birch, Black Spruce, Larch)		Lady Fern Oak fern Long Beech fern Threefruited sedge Wood Horsetail One-leaf Rein Orchis Sphagnum girghensohnii Sphagnum robustrum Snowberry Goldthread
Dryopteris-Lycopodium Balsam Fir	Balsam Fir (White Birch)		Fern species Herb species Spinulose Wood fern Actaea rubra
4. White Birch Forests			
Poplar-White Birch Forest	Aspen Red Maple White Birch (Black Spruce, Balsam Fir)		Nodding Trillium Orchid species Violets Lilies Fern species Moss species

Table VII-2 (Contin.)

Community	Tree Stratum	Shrub Stratum	Herb Stratum
5. Birch Forests (On Unstable Soils)	White Birch		
6. Black Spruce-Moss Forest	Black Spruce (White Pine, White Birch, Aspen, Balsam Fir)		Dicranum undulatum Pleurozium schreberi Hylocomium splendens Sheep laurel Snowberry Blueberry

Non-Forest Communities

Barrens comprise approximately 7 per cent of the total park area and include rock barrens, kalmia barrens, and transition barrens. Although a large portion of these areas originated from fires, succession under natural conditions may lead to the establishment of kalmia barren over many sites in the park.

Rock barrens are climax vegetation types localized on summits where climatic exposure is too severe to support tree growth. This type of habitat is rare in the park and is one of the most sensitive because of soil instability and the abundance of lichens prone to deleterious effects of disturbance.

Kalmia barrens are the result of intense or repeated burning on sites previously occupied by the kalmia - conifer or Pleurozium balsam fir forest types. They are common on a wide variety of dry soils possessing nutrient poor parent material. The most outstanding feature of the barrens is the dominant shrubs, i.e. Kalmia angustifolia, Ledum groenlandicum, Rhododendron canadense, and Vaccinium angustifolium and the part which these shrubs play in maintaining the barrens in a self-perpetuating condition.

Transition barrens represent an active successional phase from barren toward the development of a forest type. They occur infrequently within the park and develop to a wide variety of forest types which principally depend on the underlying soil conditions and the available seed sources.

Table VII-3 indicates the important vegetation components of barrens in Terra Nova National Park.

Photo VII-7. Rock Barren. This is a rare climax vegetation type localized on summits within the park. Note erratic boulders.

Table VII-3

Important Vegetation Components of Barrens In Terra Nova National Park

Community	Tree Stratum	Shrub Stratum	Herb Stratum
Barrens			
Rock Barrens	Black Spruce	Mountain Alder	Fir clubmoss Cetraria nivalis Cladonia boryi Sphaeophorus globosus Bog Billberry Pink Crowberry Rhacomitium lanuginosum
Kalmia Barrens		Sheep Laurel Rhodora Lichen Labrador Tea Blueberry	Sphagnum nemoreum Lichen species Partridgeberry
Transition Barren	Black Spruce Balsam Fir Pin Cherry Red Maple White Birch	Alder Sheep Laurel Northern Wild Raisin Upland Willow	Blueberry Corn Lily Bunchberry Twinflower Patridgeberry Starflower Wild Lily-of-the-Valley *Cladonia* species *Dicranum* species *Cladonia* species *Pleurozium schreberi* *Polytrichum juniperinum* Bracken Fern Mountain Juneerry Wild Holly

Four classes of wetlands have been recognized within Terra Nova National Park and include bogs, fens, marshes and swamps. Together, they comprise approximately twenty-one per cent of the park's total land area.

There are two types of bogs within the park; the Ombrogenous or raised bogs and the Mesotrophic bogs which usually occur on the flanks of the raised bogs. The surfaces of raised bogs are less than 1.5 meters above the surrounding terrain indicating a youthful stage in their development. This retarding of development is at least partially due to repeated burning. The ground layer is dominated by *Sphagnum* mosses and lichens (*Cladonia species*) although deer grass (*Scirpus cespitosus*) and sheep laurel (*Kalmia angustifolia*) are important components. Bake-apples (*Rubus chamaemorus*) and cranberries (*Vaccinium* species) are the most commonly occurring edible fruits.

Mesotrophic bogs usually occur on the flanks of large raised bogs in the northeastern part of the park. They are also common in closed depression or bedrock crevices where the water table is maintained near the surface because of a lack of drainage. The flora of the Mesotrophic bog is much richer than that of the raised bog and in addition to the wide variety of sphagnum mosses and sedges, there are a number of colourful wild orchids, asters, and goldenrods. Curly Grass Fern (*Shizaea pusilla*), which is near its northernmost distribution in Newfoundland, may be found on these bogs within the park.

Seepage fens and draw fens are found within Terra Nova National Park with the former being distributed on some slopes in the western part of the park and the latter being found in isolated basins within the forested areas of the

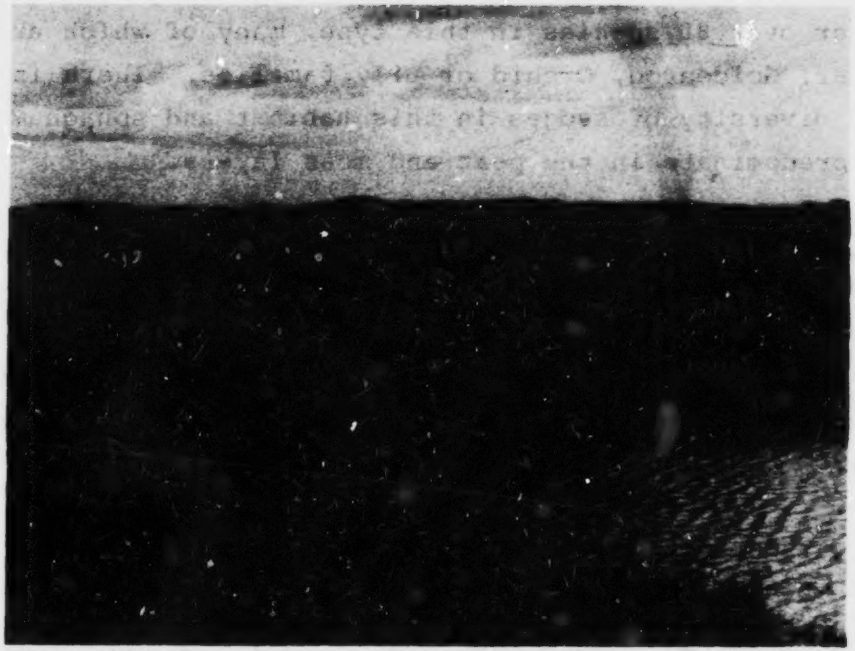


Photo VII-8. Seepage Fen, Gross Bog. Typical of seepage fens found on slopes in western part of park. Dominant vegetation consists of various species of sedge.

park. A large portion of Gross Bog (A-13) is covered by seepage fen vegetation, even though the relief would promote adequate drainage. Salton's Marsh (A-7) is also of this type. The vegetation of seepage fens is dominated by dwarf birch (Betula michauxii) over a dense herb and sedge stratum. Sphagnum mosses are the most common moss species found in this type. Draw Fens or "sedge meadows" found within the park have great floristic diversity. It is not uncommon to encounter over 80 species in this type, many of which are in the Aster, Goldenrod, Orchid or Lily families. There is also a great diversity of sedges in this habitat and sphagnum mosses predominate in the peat and moss layers.

Although true fluvial marshes are a relatively rare type in Terra Nova National Park, floodplain, estuarine, and beaver dam marshes do occur. Although they represent a small portion of the total park area, these sites are important ecologically as habitat for numerous fish, mammal and bird species.

Beaver dam marshes occur in areas of gentle relief and gradual stream gradients usually associated with lacustrine deposits and the activity of beavers. A typical example occurs in South Broad Cove (D-12). These marshes are sedge dominated with sporadic occurrence of young larch or black spruce. Sphagnum pulchrum is the dominant moss in this type with herb stratum being dominated by Blue Flag (Iris versicolr), Cotton grass (Eriophorum agnustifolium), Meadow Rue (Thalictrum polygamum), Meadowsweet (Spireaea), Rose, and Cattails (Typha latifolia).

Floodplain marshes are localized on fluvial outwash, deltas or stream levees, near Sandy Pond (B-1) and Broad Cove Pond (D-3). They are usually associated with levees in small streams, especially where the stream gradient is poorly developed. Alder and dwarf birch are the major shrub species occurring in this type with Sphagnum mosses and sedges dominating the herb stratum.

The best example of estuarine marshes occurs in the Big Brook Flats in Inner Newman Sound (A-12) but the type is otherwise very rare within the park. This is because of the dominance of bedrock as a shoreline feature throughout most of the park. The estuarine marsh forms a sedge and herb dominated community on gently sloping sandbars that are inundated at high tide. Species, which are clearly restricted to this type of habitat, include Solidago halophila, Saltmarsh Sedge (Carex salina), Rushlike Plaintain (Plantago juncoides), Three-square Rush (Scirpus americanus), and Smooth Cordgrass (Spartina alternifolia). Estuarine marshes are important feeding and nesting habitat for waterfowl.

Peat margin swamps occur on the margin of peatlands or sometimes adjoining other swamp types, especially on seepage slopes in hilly areas or in local depressions. They include the mesotrophic black spruce swamps with an open shrub layer of poorly growing alder. Sphagnum mosses and sedges (Carex) dominate the floor vegetation while sheep laurel (Kalmia angustifolia), Labrador Tea (Ledum groenlandicum), Blueberry and Partridgeberry (Vaccinium species), are dominant shrubs.

The alluvial swamps of Terra Nova National Park are only marginally developed. They are distributed on alluvial soils along brooks and creeks. Black spruce and balsam fir are common species found in this type with Meadowsweet (Spiraea latifolia), Sweet Gale (Myrica gale), comprising the shrub stratum. This type is distinguished by the dominance of Meadowsweet, Rough Goldenrod (Solildage rugosa), Bluejoint

(*Calamagrostic canadesis*), and Tall Meadow Rue (*Thalictrum polyganum*) in the understory. Rushes and sedges are also important in the herb stratum.

Seepage swamps are basically alder swamps with scattered balsam fir or white birch. This type is usually too small to be mapped and they occur on flat to slightly depressional parts of seepage slopes. Ground vegetation is dominated by clubmosses, ferns and herbaceous vegetation and the moss layer is poorly developed.

Table VII-4 lists the important vegetation components of wetlands in Terra Nova National Park.

Table VII-4

Important Vegetation Components Of Wetlands In Terra Nova National Park

Wetland Community	Tree Stratum	Shrub Stratum	Herb Stratum
Ombrogenous Bog Complex (Raised Bog)	Black Spruce	Sheep Laurel	Bluehead Lily Deer Grass/Tufted Clubrush Black Crowberry Bakeapple Cranberry *Vaccinium* species *Sphagnum* species *Cladonia* species Cetraria islandica Mylia anomala
Mesotrophic Bog Complex			*Carex* species Tufted Clubrush Hairy Fly Honeysuckle Northern Reedgrass Curly Grass Fern *Sphagnum* species *Ledidozia* repens *Cephalazia connivens*

Table VII-4 (Contin.)

Wetland Community	Tree Stratum	Shrub Stratum	Herb Stratum
Seepage Fen Complex		Dwarf Birch	Spatulate-leaved Sundew Northern Reedgrass *Sphagnum* species Marsh Goldenrod White Wood or Bog Aster New Belgium Aster Tufted Club-rush Buckbean White Beak-rush Livid Sedge
Draw Fen Complex		Dwarf Birch	Sweet Gale Livid Sedge Buxbaum's Sedge New Belgium Aster White Wood or Bog Aster Canada Rush Shrubby Cinquefoil Northeastern Rose Hairy Fly Honeysuckle Selaginella selaginoides Thalictrum polygonum Campylium stellatum *Sphagnum* species
Beaver Dam Marsh	Larch Black Spruce	Swamp Birch Speckled Alder	*Sphagnum* species Blue Flag Cotton Grass Meadow Rue Meadowsweet Cattails *Sedge* species Northeastern Rose Shrubby Cinquefoil Hairy Fly Honeysuckle Bluejoint White Wood or Bog Aster

Table VII-4 (Contin.)

Wetland Community	Tree Stratum	Shrub Stratum	Herb Stratum
Flood Marsh		Speckled Alder Newfoundland Dwarf Birch	Goldenrod Rushlike Plaintain Flatleaved Bladderwort *Sphagnum* species Meadowsweet Sweet Gale Northeastern Northern Reed Grass Northeastern Rose Blue Flag White Wood or Bog Aster Marsh Goldenrod
Estuarine Marsh		Speckled Alder Trailing Juniper	Goldenrod Rushlike Plaintain Three-square Rush Smooth Cordgrass Saltmarsh Sedge Blue Flag Bluejoint Twin Bentgrass Silverweed Virginian Rose Common Yarrow Vetchling Fall Dandelion
Peat Margin Swamp	Black Spruce	Speckled Alder Sheep Laurel Labrador Tea	*Carex* species Vaccinium species Three-leaved False Solomon's Seal *Sphagnum* species
Alluvial Swamp	Balsam Fir Black Spruce	Speckled Alder High Bush Cranberry	Sweet Gale Meadowsweet Rough Goldenrod Sedge species Rush species Blue Flag Marsh Blue Violet Bluejoint Dewberry Tall Meadow Rukle Shortplume grass

Table VII-4 (Contin.)

Wetland Community	Tree Stratum	Shrub Stratum	Herb Stratum
			Wild Lily-of-the Valley Northern Bugleweed Joe-Pye-weed Redstemmed Aster *Rhytidiadelphus* *Mnium* *Sphagnum fallax*
Seepage Swamp	Balsam Fir White Birch	Speckled Alder	Shining Clubmoss Stiff Clubmoss Wood Horsetail Swamp Thistle Bog Candle Water Avens Smaller Enchanter's Nightshade Bedstraw

Relative Abundance of Species

In Terra Nova National Park, black spruce (*Picea mariana*) and balsam fir (*Abies balsamea*) comprise either singly or in association, the matrix of a forest cover which is almost exclusively coniferous (Gauthier et al, 1977). The lesser vegetation is represented mostly by mosses and shrubs.

According to Baird (1980), the black spruce associations (including the Pleurozium complex) were the most common in all the plots studied during the establishment of the Permanent Biophysical Sample Plots (P.S.P.). In 74.2 per cent of the forested plots completed, black spruce was the dominant tree species, while balsam fir and larch occurred on only 16.1 per cent and 3.2 per cent respectively.

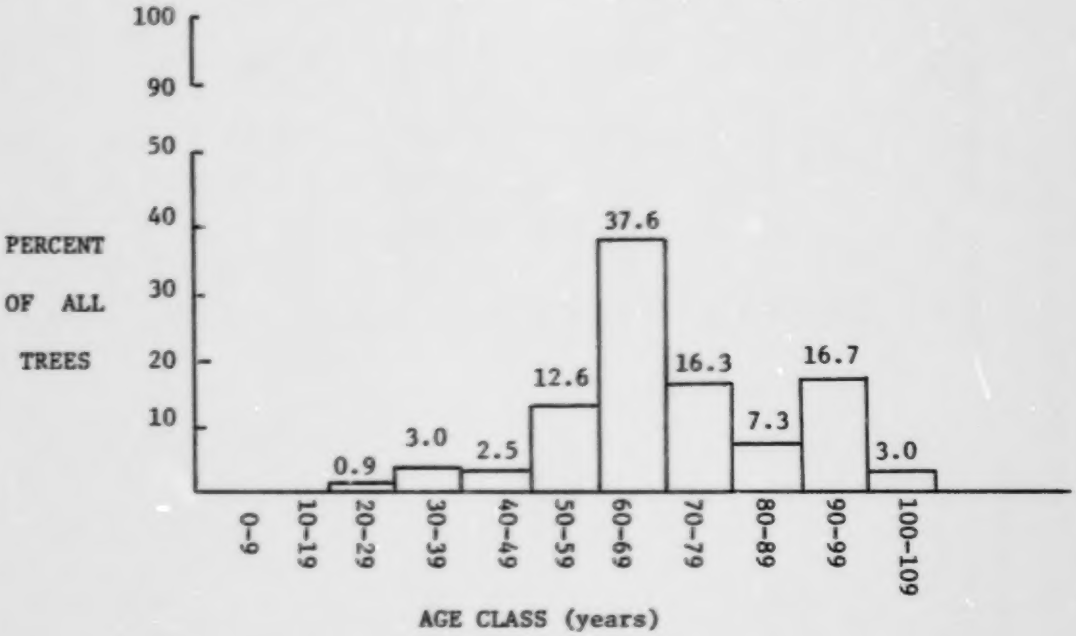
The condition and vigour of black spruce in the park is much better than the balsam fir as most stands of the former are only lightly affected by the spruce budworm (Choristoneura fumiferana). Balsam fir, occurring in dense, overcrowded stands has been the hardest hit and in the southern section of the park, severe defoliation of pure stands has left much dead or dying timber. Although the Biophysical (Gauthier et al, 1977) considers balsam fir to be the climax species for many areas of the park, the tree's susceptibility to insects, disease and other damage, such as heavy browsing pressure by moose and snowshoe hare, may seriously affect the probability of this ever occurring.

Even though the condition and vigour of the black spruce in the park is much better than that of the balsam fir, most of the spruce stands contain small trees showing poor growth. Of all spruce trees sampled during the P.S.P. establishment program, 82.5 per cent fell into the 14 cm. diameter class or lower (see Figure VII-2) and the average annual growth for the species was computed as only 0.255 cm./year (Table VII-5). Most of this can be attributed to site quality and/or stand density. In fact, for the major species in the park, the annual growth seemed very low, reaching 0.30 cm./year and 0.315 cm./year for balsam fir and larch respectively and only 0.227 cm./year for white birch (Table VII-5). Poor growth can also be attributed to the fact that most of the park's forest are in a mature to overmature stage. Using the following age class guidelines:

Figure VII-2

Per Cent of Black Spruce Trees in Each Age Class and Each Diameter Class in Terra Nova National Park

BLACK SPRUCE: AVERAGE AGE - 65.1 YEARS
NOTE: GRAPHS ARE FOR TREES OVER 4cm AT D.B.H.



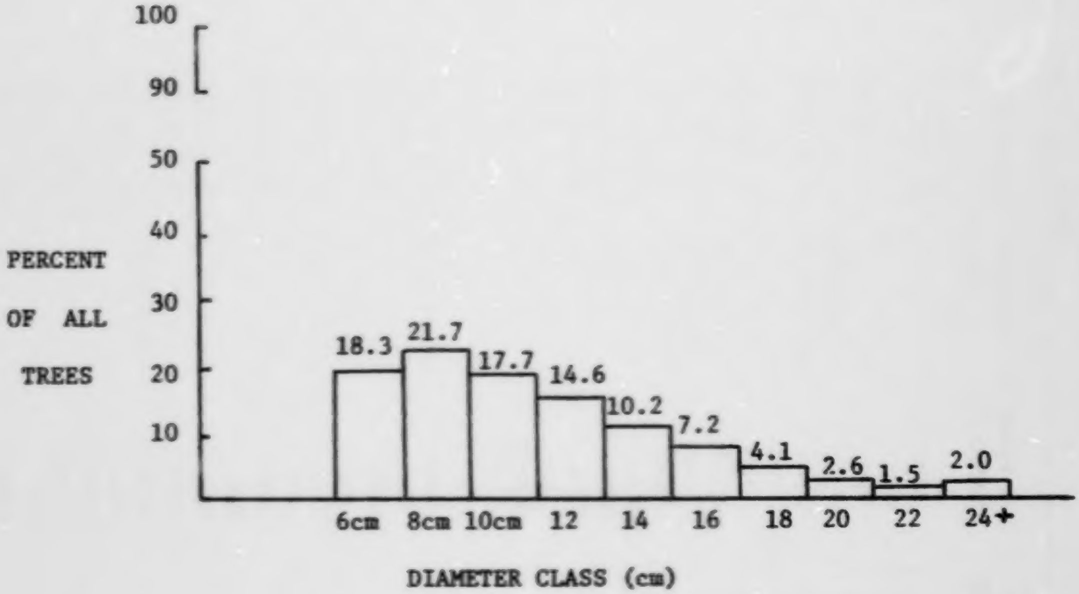


Table VII-5

Average Height and Average Annual Increment And Per Cent Ground Cover By Plant Community In Terra Nova National Park

PLOT NUMBER	PLANT COMMUNITY	AVERAGE HEIGHT/AVERAGE ANNUAL INCREMENT (metres) (centimetres) bf	bS	wB	L	PERCENT GROUND COVER K	CL	Pl	Hyl
2	bSMITT		10.0/0.20						
3	Sws								
4	KwB		9.5/0.42	15.7/0.29		90			
5	RubF	9.8/0.31	11.8/0.24			25		80	
6	Hybf	10.0/0.44	11.8/0.24	6.0/0.21		70		50	30
7	TawB			8.2/0.25		60	25 Cornus		
9	Kbs		8.5/0.22			90			
10	CabF	6.5/0.21	8.3/0.20			40	70 Sphagnum		
11	UwB	8.0/0.33	9.8/0.22					50	
12	bSMV		12.7/0.22			10		80	20 Cornus
13	unstated		6.8/0.19			20	Lab.Tea &	20	Sphagnum
15	bSMIII		12.5/0.29			45		85	
16	ClbS		8.5/0.40		5.3/0.29	80	80		
17	ClbS		6.2/0.49		7.1/0.34		80		
18	bSMIII		9.7/0.24						
19	FD					25	40	80 Cotton Grass 30 Sphagnum	
20	UwB	11.2/0.24	13.0/0.24	9.8/0.21			60 Cornus		
21	UwB		12.6/0.27			40 Flowering plants			
22	bSMI		9.7/0.21						
23	Mab								
24	PlbF	12.0/0.29	11.7/0.37			15 Sphagnum		40	40
25	Fs						40 Graminae		
26	bSMV		12.0/0.29					40	40
27	Bat					90			
28	SpKbS		6.8/0.09			80	30 Sphagnum		
29	KbS		6.7/0.28			85			
36	HybF	9.8/0.29							
37	PlbF		8.3/0.17					90	
45	CabF		9.8/0.16						
48	ClKbS		8.7/0.26			40	85		
49	Bar					60			
53	bSMIII		10.7/0.21						
55	P					30 Alder, 30 Carex, 40 Rubus spp.			

	CONIFEROUS	DECIDUOUS
	AGE	
Early regeneration stage	0 - 10	0 - 5
Young, healthy, vigorous growth stage	10 - 30	6 - 20
Intermediate to mature stage	31 - 70	21 - 50
Overmature, decadent successional stage	70+	50+

93.5 per cent of the black spruce sampled was in the 50+ age class, while 43.3 per cent would be considered overmature (70+). For balsam fir, 88.9 per cent fell into the 40-60 year age class while only 11.1 per cent would be considered overmature (Figure VII-3).

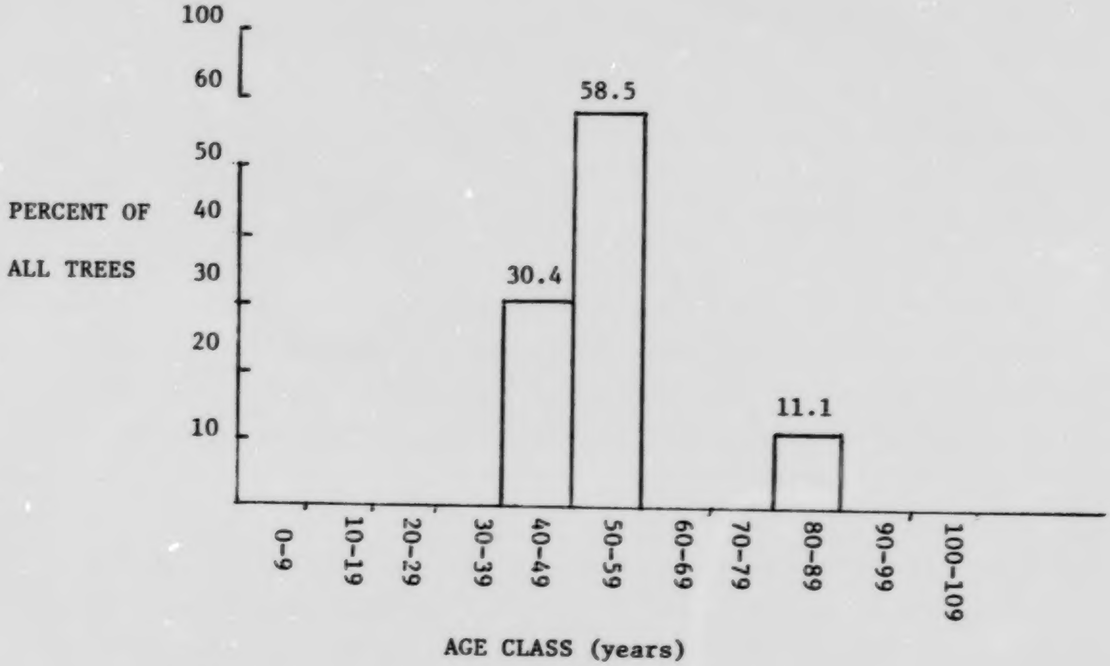
The dominant deciduous species in the park is white birch, much of which is decadent or in poor condition. Again, from the trees sampled during the P.S.P. program, 100 per cent were considered in the overmature, decadent successional stage. Many of these areas will probably revert to a predominantly spruce stand type as it was the major understory species in most of the plots sampled. Growth in white birch is also low as indicated previously, with 75.2 per cent falling into the 14 cm. diameter class or lower. White Birch occurred on 6.5 per cent of the forested plots studied during the Biophysical (Figure VII-4).

Of the park's understory vegetation, Kalmia is the most common. It was dominant or present in 72.2 per cent of all the Biophysical plots. Pleurozium moss and bunchberry (Cornus canadensis) were observed frequently as well.

Figure No. VII-3

Per Cent of Balsam Fir Trees in Each Age Class
and in Each Diameter Class in Terra Nova National Park

BALSAM FIR: AVERAGE AGE - 55.4 YEARS
NOTE: GRAPHS ARE FOR TREES OVER 4 cm AT D.B.H.



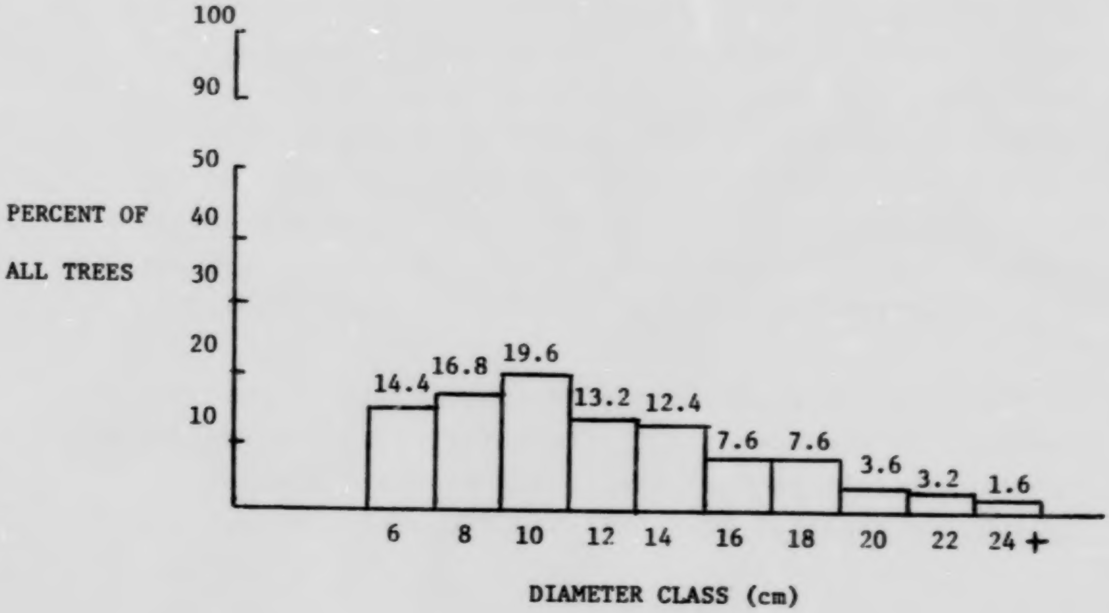
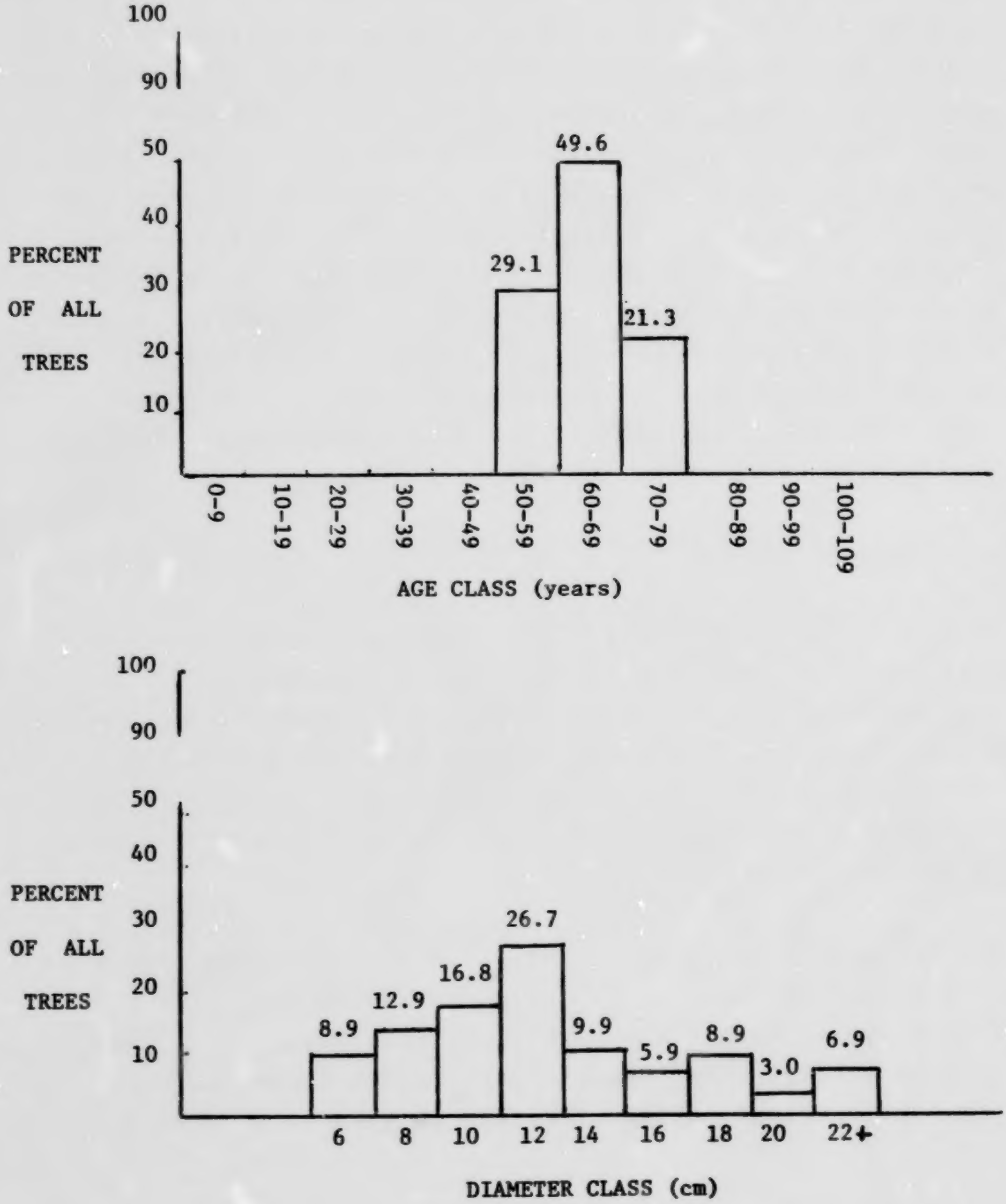


Figure No. VII-4

Per Cent of White Birch Trees in Each Age Class and Each Diameter Class in Terra Nova National Park

WHITE BIRCH: AVERAGE - 67 YEARS
NOTE: GRAPHS ARE FOR TREES OVER 4cm AT D.B.H.



Certain plant associations were found to occur commonly. Black spruce - Kalmia - Pleurozium were found in association on 36 per cent of the forested plots, while black spruce - Kalmia occurred in 56 per cent (Baird, 1980).

During the Initial Environmental Evaluation of the Terra Nova National Park Golf Course Area, a number of vegetation sample plots were also established (Millette, 1979). Vegetation was basically found to be similar to the rest of the park with black spruce occurring in all plots and sheep laurel in 80 per cent of them (Figure VII-1). Alder and birch were also found to be common. Of significance and occurring in the frequency of 30 to 40 per cent were the following species: white pine, red maple, willow, northern wild raisin, and Cladonia species. Blueberry, Labrador Tea, rhodora and bunchberry were found in about 50 per cent of the cases. Similarly, larch, balsam fir and moss species were identified in 47 to 50 per cent of the sample plots.

Successional Trends

Within Terra Nova National Park, there are very few areas that have not been affected by natural and human disturbances. Prior to the park's establishment, logging was a major industry in the area and much of the forest was selectively cut. Fires have also been an important factor influencing succession, both prior to and since the opening of the park.

For the most part, logging removes a major portion of the seed producers required for regeneration of the original forest type. Within the park area, succession after past logging activity has tended towards black spruce as the dominant species. Balsam fir, though favored to dominate on the richer sites, has been replaced by the black spruce. The factors which favor this latter species include the presence of a better supply of black spruce seeds, a greater tolerance by black spruce to site disturbances, a severe intensity of moose browsing on balsam fir regeneration, and balsam fir mortality caused by insect infestations.

Most black spruce types within the park originate from fires and are somewhat stable. Black spruce - moss forest types which occupy sites normally colonized by balsam fir - white birch are relatively stable since moose browsing and severe spruce budworm infestations hinder balsam fir colonization of such sites. Kalmia - black spruce, which is present in much of the park, has an unstable successional status and it is not certain if this forest type exists as a transitional type or if it can also occur as a stable type in undisturbed habitats. Where it occurs on sandy loams or loams it will eventually become a Pleurozium - fir forest. It appears that most Kalmia - black spruce forests in the park have been derived from other black spruce - moss forest types through select cutting or poor seed supply and/or germination following fire. Where black spruce regeneration is adequate in small cutovers, succession will tend to black spruce - moss.

Most balsam fir forest types are also stable, but when disturbed, tend towards black spruce. Provided soil properties remain stable, the Pleurozium - balsam fir type will tend towards Kalmia - black spruce. With unstable soil conditions, the successional possibilities include Sphagnum - Kalmia - black spruce, Kalmia - white birch, or Kalmia barrens. Poplar - birch forest types are also a possible successional type for balsam fir after disturbance as are alder swamps if there is a change in moisture regime. Again, limiting factors such as intense moose browsing are important to regeneration and succession of balsam fir.

Most white birch forest types within the park are successional stages which resulted after fire in coniferous stands. They have evidently developed when there was an insufficient black spruce seed supply. Natural succession of Kalmia - white birch stands will probably lead to a Pleurozium - or Hylocomium - balsam fir forest type either directly or through a Kalmia - black spruce seral stage. Seed supply of surrounding forest stands will probably be the limiting factor in determining the rate and type of succession. After fire, existing stands will lead to development of Kalmia - black spruce forest.

Trembling aspen stands, which are rare within Terra Nova National Park, result following disturbance by fire. The two known stands in the park occur on Lycopodium - alder swamp sites.

Successional trends within the park's non-forested areas are very slow as most barrens and wetlands are climax vegetation types. There are exceptions, however, including transition barrens, floodplain marshes, alder swamps, and seepage swamps. The transition barren is an active successional phase toward the development of a forest type. The exact type will depend on the edaphic conditions of the site considered and the seed source and the time required will generally be between 10-20 years. The successional trends in floodplains, alder swamps, and seepage swamps depend to a large degree on drainage conditions. As water levels drop or areas become drier, other vegetation types which were intolerant of the previously saturated condition colonize or expand into an area. In seepage or alder swamps, balsam fir is the major tree species to succeed. These areas are too small to be of major importance.

Table VII - 6*

Seed Characteristics, Light Requirements, Survival In Thick Moss Carpet, and Germination Ability of Three Tree Species In Terra Nova National Park

Species	Seed Characteristics	Light Requirements	Ability To Survive In Thick Moss Carpet	Ability To Germinate	
				Under Forest	After Fire
Balsam Fir	heavy seeds; released all at the same time in the Fall	low	high	good	very low
Black Spruce	cones stay on the tree, seeds slowly released, seeds crop always available	high	very low**	very low	high
White birch	light seeds, travel far; prefer rich soils	very high	moderate	in small opening	not particularly adapted to fire

*(After Damman, 1964)

**To compensate, black spruce propagates by means of layering, in open forests with thick moss carpet.

Forest Insects

The forested areas of Terra Nova National Park have been affected several times during the park's history by various insect pests. With most of the park's forest in a mature to overmature stage, these infestations have caused a great deal of tree mortality and subsequent blowdown. In particular, balsam fir has been hardest hit by past attacks of the balsam wooly aphid as well as the recent spruce budworm infestation.

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Section VIII

MAMMALS

The Island of Newfoundland resembles an oceanic island rather than a continental shelf island in that it has only 14 species of native mammals, whereas the mainland, only 18 km across the Strait of Belle Isle, has 42 species. This paucity of terrestrial mammals is apparently explained by the lack of a post-glacial land connection with the mainland. While it has been suggested that the endemic species in Newfoundland survived the last glaciation in an unglaciated area off the coast, rather than on the southern mainland of North America, the theory of colonization from the mainland is accepted by most authors (Bateman, et al 1983).

Subspecies of Mammals Native to Insular Newfoundland

Eight of twelve land mammal species (exclusive of bats) native to Insular Newfoundland are accorded subspecific status by Banfield (1974) (Table VIII-1), and some authors consider a higher number of distinct forms.
Sub-specification requires that a population be isolated from its parent population over a period of time such that distinct differences may occur as a result of the limited gene pool in the small colonizing group of animals, mutations in an isolated population, and/or adaptation to differences in the new environment through natural selection. The designation of a subspecies is somewhat subjective, and is often debated by taxonomic authorities whose opinions differ

on the significance of minor differences in pelage colouration, size, etc. Nevertheless, an insular subspecies distinctly different from the mainland form usually indicates a long period of geographic separation of the two populations (Bateman, et al 1983).

Table VIII-1

Subspecies of Mammals Native to Insular Newfoundland

Common Name	Subspecies	Other location where occurs
Arctic hare	Lepus arcticus banpeii	Labrador
American beaver	Castor canadensis caecutor	- -
Meadow vole	Microtus pennsylvanicus terranovae	
Muskrat	Ondatra zibethicus obscurus	- -
Wolf	Canis lupus beothucus	- -(extinct)
Red fox	Vulpes vulpes deletrix	- -
American black bear	Ursus americanus hamiltoni	- -
Weasel (ermine)	Mustela erminea richardsonii	across Canada
American marten	Martes americana atrata	Labrador
River otter	Lutra canadensis degener	- -
Lynx	Lynx lynx subsolanus	- -
Caribou	Rangifer tarandus caribou	across Canada

*Banfield, 1974.

Population Trends Following Introduction

A species introduced into a favourable habitat will often show a very fast increase in numbers after an initial period of adjustment. The initial slow increase is caused by the introduced individuals' need to adjust to the new surroundings, and also by the limited number of breeding animals. If the habitat is suitable for the species, a high rate of reproduction and a fast numerical increase follows the initial phase. Advantages of a new habitat include: predators are frequently few and not accustomed to the new prey, the habitat is relatively disease-free, inter- and intra-specific competition is minimal, food and cover is abundant.

Following a rapid increase in population, the rate of increase declines and the total population size stabilizes and will often decrease below the maximum. The decrease in survival and/or reproduction that caused the population to stabilize may be brought about by increased predation, increased incidence of disease and parasites and/or increased competition for food and shelter.

There is some evidence that this typical sequence of events occurred after the introduction of the masked shrew to Newfoundland (Bateman, et al 1983). After a high population density of shrews became established in a locality, the population then decreased as the impact of local mortality factors increased; meanwhile, some shrews dispersed into surrounding unoccupied habitat and the population trend followed the same pattern.

Terrestrial Mammals in Terra Nova National Park

We now have 22 species of terrestrial mammals on the park list (See Table VIII-2). Besides seven introductions, this list included two species which are accidental visitors, arriving from the north via drift pack ice; the Arctic Fox Alopex lagopus and the Polar Bear Ursus maritimus.

Table VIII-2

Status of the Land Mammals of Terra Nova National Park

	Status*	
Order INSECTIVORA		
Family SORICIDAE (shrews)		
Sorex cinereus (Masked Shrew)	I	A
Order CHIROPTERA (Bats)		
Family VESPERTILIONIDAE (Common Bats)		
Myotis lucifugus (Little Brown Bat)	U	
Myotis keenii (Eastern Long-eared Bat)	H (check records)	
Order LAGOMORPHA (Rabbits and Hares)		
Family LEPORIDAE (Hares)		
Lepus americanus (Snowshoe Hare)	I	A
Order RODENTIA (Rodents)		
Family SCIURIDAE (Squirrels)		
Tamiasciurus hudsonicus (Red Squirrel)	I	R
Family CASTORIDAE (Beavers)		
Castor canadensis (Beaver)		U (locally C)
Family MURIDAE (Rats, Mice and Voles)		
Microtus pennsylvanicus (Meadow Vole)		C (locally A)
Ondatra zibethicus (common Muskrat)		R
Rattus norvegicus (Norway Rat)	I	U
Mus musculus (House Mouse)	I	U
Order CANIVORA (Carnivores)		
Family CANIDAE (Wolves, Dogs, Foxes)		
Canis lupus (Timber Wolf)	X	
Alopex lagopus (Arctic Fox)	V	
Vulpes vulpes (Red Fox)	R	

Table VIII-2 (contin.)

	Status*	
Order INSECTIVORA		
Family SORICIDAE (shrews)		
Sorex cinereus (Masked Shrew)	I	A
Order CHIROPTERA (Bats)		
Family VESPERTILIONIDAE (Common Bats)		
Myotis lucifugus (Little Brown Bat)	U	
Myotis keenii (Eastern Long-eared Bat)	H	(check records)
Order LAGOMORPHA (Rabbits and Hares)		
Family LEPORIADE (Hares)		
Lepus americanus (Snowshoe Hare)	I	A
Order RODENTIA (Rodents)		
Family SCIURIDAE (Squirrels)		
Tamiasciurus hudsonicus (Red Squirrel)	I	R
Family CASTORIDAE (Beavers)		
Castor canadensis (Beaver)		U (locally C)
Family MURIDAE (Rats, Mice and Voles)		
Microtus pennsylvanicus (Meadow Vole)		C (locally C)
Ondatra zibethicus (Common Muskrat)		R
Rattus norvegicus (Norway Rat)	I	U
Mus musculus (House Mouse)	I	U
Order CARNIVORA (Carnivores)		
Family CANIDAE (Wolves, Dogs, Foxes)		
Canis lupus (Timber Wolf)	X	
Alopex lagopus (Arctic Fox)	V	
Vulpes vulpes (Red Fox)	R	

Table VIII-2 (contin.)

	Status*
Family URSIDAE (Bears)	
Ursus americanus (Black Bear)	C
Ursus maritimus (Polar Bear)	V
Family MUSTELIDAE (Weasel)	
Mustela erminea (Weasel)	R
Mustela vison (Mink)	I R
Martes americana (Marten)	Hi
Lutra canadensis (Otter)	C
Family FELIDAE	
Lynx lynx (Canada Lynx)	
Order ARTIODACTYLA	
Family CERVIDAE (Deer)	
Alces alces (Moose)	I C
Rangifer tarandus (Caribou)	V

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*A - Abundant, numerous
C - Common (widespread but not abundant)
U - Uncommon (not widespread, may be locally common)
R - Rare (present but in very low numbers)
H - Hypothetical (no confirmed records but presence suspected)
X - Extinct now, present in past
V - Accidental visitor
I - Introduced to Insular Newfoundland
i - Being re-introduced

Marine Mammals Found in Waters Adjacent to Park

There are 22 species of marine mammals possible in Newfoundland waters, and seven of these have been recorded in waters adjacent to the park. Thirteen of this group are whales and porpoises, and four are seals. Table VIII-3 lists marine mammals possibly found adjacent to park waters.

Table VIII-3
Marine Mammals Possible in Waters Adjacent
Terra Nova National Park

Whales
  Toothed Whales
  Beaked Whales
  Beaked Whale - Mesoplodon bidens
  Bottlenose Whale - Hyperoodon ampullatus
Sperm Whale
? Sperm Whale - Physeter catodon
White Whale
* White Whale - Delphinapteras leucas
Dolphins and Porpoises
* Common Dolphin - Delphinus delphis
* White-beaked Dolphin - "Squidhound" - Lagenorhynchus albirostris
* Atlantic White-sided Dolphin - "Jumper" - Lagenorhynchus acutus

* Killer Whale - Orcinus orca
* Atlantic Pilot Whale - "Blackfish" - Globicephala malaena
* Harbour Porpoise - Phocoena phocoena
Whalebone Whales
  Rorquals

Table VIII-3 (contin.)

- * Finback Whale - Balaenoptera physalus
- * Sei Whale - Balaenoptera borealis
- * Minke Whale - Balaenoptera acutorostrata
- * Blue Whale - Balaenoptera musculus
- * Humpback Whale - Megaptera novaeangliae

Bowhead Whales

- * Right Whale - Balaena glacialis

Seals

True Seals

- * Harbour Seal - "Ranger"
- * Ringed Seal - "Jar"
- * Harp Seal
- * Bearded Seal
- * Gray Seal
- * Hooded Seal

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* Indicates one or more sightings adjacent the park shoreline.

Methods Used to Study Mammal Populations

A base document for the Mammal Study at Terra Nova National Park has been the Biophysical Survey prepared by Gauthier et al; however, the vegetation maps, which would be best to define habitat, do not provide the detail desirable, or are difficult to interpret because vegetation type lines were adjusted to conform with land types.

In his preliminary work, Roscoe (1978-1979) summarized many research subjects; e.g. autopsies, small mammal trapping, beaver activity, and aerial surveys for moose. Warden staff have continued this effort, and regular reports on monitoring projects, special studies continue.

In addition to sources mentioned, habitat surveys, browse surveys, browse exclosure plots, pellet counts and scat collections have all contributed to the accumulation of knowledge concerning park mammals. Wildlife observation cards, which are completed by staff with various degrees of training are, when analyzed, often quite useful.

Table VIII-4 provides information on reproduction characteristics of common terrestrial mammals of Terra Nova National Park.

Table VIII-4

Reproductive Information on the Common Terrestrial Mammals of Terra Nova National Park

Species	Breeding Season	Gestation Period/Days	Number Litters Per Year	Number of Young Litter	Average Number Young Per Litter
Masked Shrew	May to September	18	1	up to 11	4-5
Little Brown Bat	September to October	90 (approx.)	1	1	1
Snowshoe Hare	March to August	36	2-3	2-4	-
Red Squirrel	February to March and June to July	38	2	3-7	-
Beaver	February	110-12-	1	1-5	2-3
Meadow Vole	Spring to Fall	22	3-5	1-9	-
Common Muskrat	March to August	22-30	2-3	1-11	6
Red Fox	February	52	1	4-10	5-6
Black Bear	June to July	220°	1*	1-3	2

Table VIII-4 (contin.)

Species	Breeding Season	Gestation Period/Days	Number Litters Per Year	Number of Young Per Litter	Average Number of Young Per Litter
Weasel	Early summer	10 Months• (young born in April/ May)	1	4-13	5-6
Mink	February to March	39-76• (young born in April/ May)	1	3-10	4
Marten	July to August	220-275• (young born in March/ April)	1	3-4	-
Otter	Late winter	about 1 year later in March/ April	1	1-6	2-3
Lynx	February to March	60 (approx.)	1	1-4	3
Moose	September to October	245	1	1	1
Caribou	Sept. to Oct.	240	1	1-2	1

• - Delayed fertilization/implantation
* - Breeding occurs every second year
From Northcott (1974)

Descriptive Notes on Resident Mammal Species

Soricidae (Shrews)

The Masked Shrew was introduced to Newfoundland in 1958 to prey upon the cocoons of the larch sawfly. A decade after the original introduction, the shrew became established in the park. Initial populations were very high. Trapping results on the Dunphy's Pond Road give a range of up to 13.2 shrews/100 trap nights in 1979 (Table VIII-5). To date, a decline in numbers has been noted every four years; 1971, 1975 and 1979 (Bateman, et al 1983). This shrew prefers moist conifer and mixed wood stands of black spruce, balsam fir and white birch, with a high crown density.

Vespertilionidae (Common Bats)

Bats reported in the vicinity of the outdoor theatre at Newman Sound are undoubtedly the Little Brown Bat. This species is classified as uncommon, and the Eastern Long-eared Bat as hypothetical until a confirmed identification of a specimen is possible.

Leporidae (Hares)

Although there is some confusion about the exact date, Snowshoe Hares were introduced to Newfoundland as early as 1864, and populations were termed very high on the Avalon Peninsula by 1896.

Population trends of Snowshoe Hares in Terra Nova National Park have not been especially documented. It has been noted that this species was very abundant in 1976-77. As is the case elsewhere in North America, cyclic population fluctuations occur, with peaks occurring every nine or ten years.

Table VIII-5

Catch per 100 Trapnights of Meadow Vole and Masked Shrew in Vegetation Types Sampled in Terra Nova National Park, September 1979.

Vegetation Type	Shrew per 100 Trapnights	Vole per 100 Trapnights
FOREST		
Kalmia-black spruce	2.6	0.0
Sphagnum-Kalmia-black spruce	0.5	0.0
Cladonia-Kalmia-black spruce	1.5	0.0
Kalmia-white birch	4.7	10.5
Pleurozium-balsam fir	10.2	0.5
Hylocomium-balsam fir	10.3	0.0
Hylocomium-balsam fir	1.5	0.0
Hylocomium-balsam fir	6.1	0.0
Black spruce-moss	4.8	0.0
Black spruce-moss	13.2	0.0
BARREN		
Kalmia barren	0.0	0.0
Transition barren	1.6	0.0
WETLAND		
Seepage fen	0.0	0.0
Floodplain marsh	5.1	0.5
DISTURBED		
Roadside	0.0	0.0

Good hare habitat is not plentiful in Terra Nova National park, an exception being the young balsam fir stands in the western part of the park, and in the vicinity of Clode Sound. Table VIII-6 provides data on hare browsing preferences in the park.

The Arctic Hare, Lepus arcticus, has not been reported either formerly or as a contemporary member of the faunal community of the park.

Snowshoe Hares prefer dense conifer cover during periods of inactivity, and the edges of swamps, roadsides, softwood and mixed wood types, as well as alder beds during nocturnal feeding forays.

Sciuridae (Squirrels)

Red Squirrels have been introduced to three sites in Newfoundland. The first introduction was to the Great Northern Peninsula in 1963. Two subsequent introductions (which have probably provided the pioneers currently invading the park), were to Camel Island, Notre Dame Bay (1964) and the Salmonier River (1974).

The Red Squirrel was by late 1980 a rare species in Terra Nova National Park. There were 13 records for 1981 from widely scattered areas from Eastport Road to Cobblers Day Use site and east to Park Harbour. Records for 1982 continued the trend began in 1981, indicating a slow but steady spread into new territory. The first record for the park was late 1977 (October ?) when a single animal was reported near the administration building.

Preferred habitat for Red Squirrels are cone bearing

Table VIII-6

Availability, Use, and Preference of Woody Plants by Snowshoe Hare in Terra Nova National Park. (June, 1978)

Species	West of Trans-Canada Highway			East of Trans-Canada Highway		
	Per Cent Available	Per Cent Total Browsed Twigs	Preference Factor	Per Cent Available	Per Cent Total Browsed Twigs	Preference Factor
Black spruce*	-	6.6	-	-	44.8	-
Alder	84.1	39.6	0.57	69.5	11.8	0.50
Balsam fir*	-	8.7	-	-	13.1	-
Common juniper	4.7	23.8	6.15	0.0	0.0	-
Labrador tea	0.3	0.0	0.0	10.3	10.6	3.05
Kalmia*	-	2.4	-	-	8.2	-
Rhodora	2.6	0.0	0.0	13.3	9.6	2.14
Blueberry	2.7	4.8	2.15	0.4	0.0	0.0
Red maple	1.1	4.8	5.27	0.0	0.0	-
Serviceberry	0.5	0.8	2.00	2.5	1.0	1.20
Wild raisin	0.2	2.1	13.00	0.4	0.0	0.0
Mountain holly	1.2	1.6	1.58	0.3	0.2	2.00
Mountain maple	0.4	1.3	4.00	0.1	0.2	6.00
White birch	0.2	1.3	8.00	0.3	0.2	2.00
Willow	0.3	1.3	5.33	0.0	0.0	-
Larch	0.6	0.5	1.00	9.6	0.0	0.0
Mountain ash	0.1	0.3	3.00	0.0	0.0	-
Cherry	0.0	0.0	-	0.1	0.2	6.00

* Unbrowsed twigs were not tallied for black spruce, balsam fir, and kalmia. Data for these species were not used in the calculation of per cent available and preference factor.

softwood forest, but mixed wood and deciduous stands could be utilized. All observations in the park to date have been associated with conifer forests.

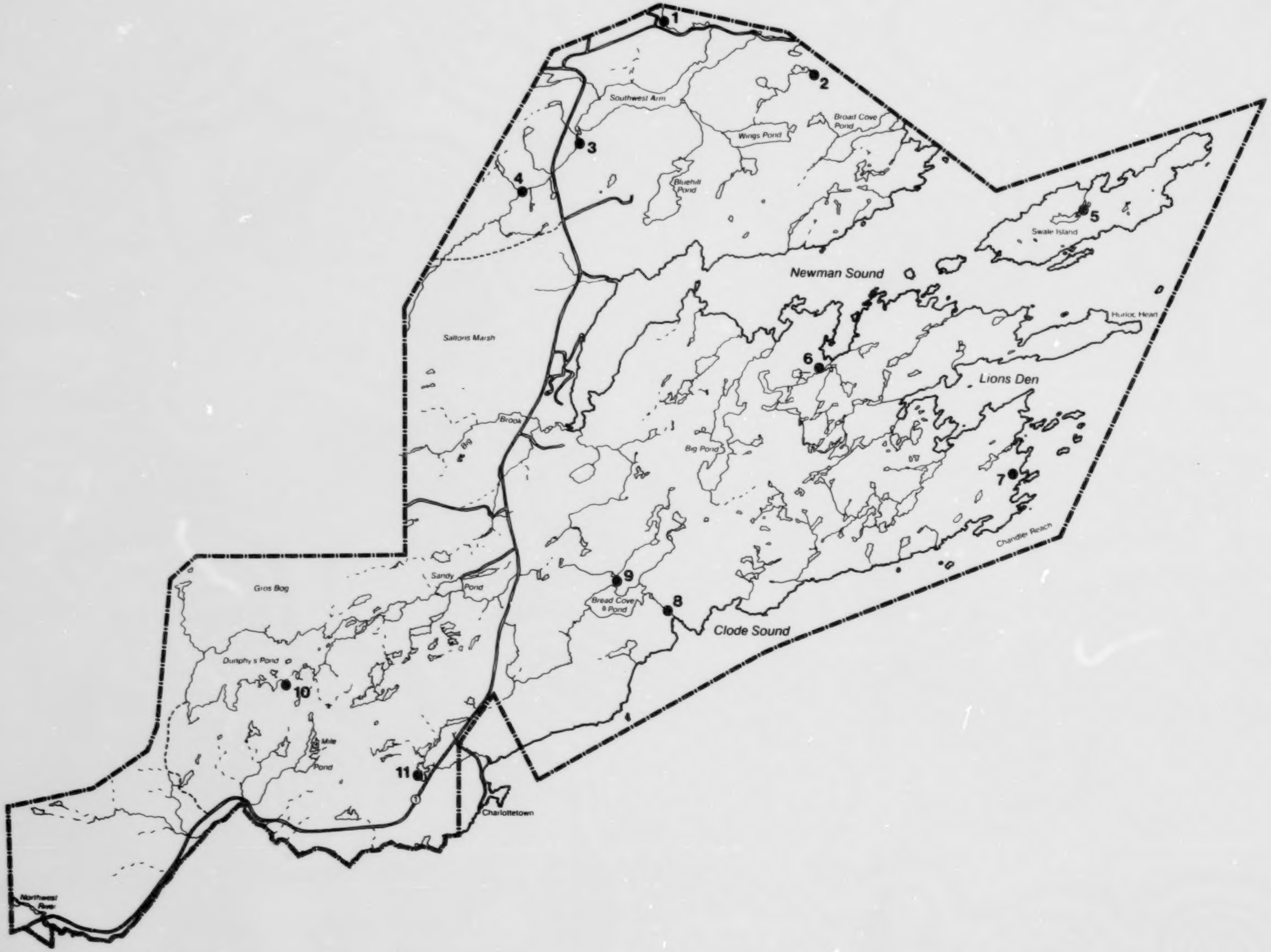
Castoridae (Beavers)

For several years the number of active beaver colonies in the park has been in the order of 10/11, and the estimated number of occupants of these same colonies has been estimated to be 20. In spite of this apparently low relative number, the beaver population is judged to be in balance with the carrying capacity of the environment. It is noteworthy, however, that beavers have over time occupied almost every pond in the park. There are over 100 known inactive lodges in the park (Bateman, et al 1983). The location of currently active beaver colonies is shown on Map VIII-1.

The residence period in most colony sites is abnormally short in the park, presumably because food quantities are in low volume. Colonies between 8 and 11 years of age at South West Brook and Burnt Point appear to be an exception to this situation, and their permanency appears related to a better than average range of food available in significant quantities (Table VIII-7).

Beavers seek out aspen when it is available, as this species is a preferred food. In quantity consumed, however, it ranks behind alder and white birch as these two last mentioned species are more consistently occurring, and available in much greater quantity than aspen.

Terra Nova National Park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Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
Newman Sound
Hurloc Head
Sailors Marsh
Lions Den
Brook
Big Pond
Chandler Reach
Gros Bog
Sandy Pond
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
Northwest River

MAP VIII-1

Locations of Active
Beaver Lodges In
Terra Nova National Park

1. Burnt Point Area
2. Green Hill Ponds
3. Lower Southwest Brook
4. Upper Southwest Brook
5. Mosses Cove Pond
6. South Broad Cove
7. East of Field Harbour Pond
8. Lower Bread Cove Brook
9. Bread Cove Pond
10. South Shore - Dunphy's Pond
11. Yudle Pond

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4
N

Table VIII-7

Availability, Use, and Preference of Woody Plants Cut By Beaver at Two Colonies in Terra Nova National Park, September 1979.

Species	Burnt Point Colony			Southwest Brook Colony		
	Per Cent Available	Per Cent Beaver-cut	Preference Factor	Per Cent Available	Per Cent Beaver-cut	Preference Factor
Alder	30.3	43.5	1.4	60.4	73.1	1.2
Viburnum	13.6	2.2	0.2	23.7	2.3	0.1
Black spruce	10.6	12.3	1.2	-	-	-
Mountain holly	13.0	3.6	0.3	7.8	0.8	0.1
Raspberry	9.7	0.2	0.02	-	-	-
White birch	7.9	15.2	1.9	1.7	1.5	0.9
Mountain maple	7.3	5.1	0.7	-	-	-
Cherry	2.2	5.1	2.3	6.2	20.8	3.3
Willow	3.1	10.4	3.3	0.1	1.5	15.0
Serviceberry	0.5	0.2	0.4	-	-	-
Red maple	1.0	1.2	1.2	-	-	-
Trembling aspen	0.7	1.0	1.4	-	-	-
	99.9	100		99.9	100	

note: Species not cut by beaver are not considered in these calculations. For example alder made up only 11.1% of stems at Burnt Point when all 27 species of woody plants are included in the calculation. The exclusion of uncut species clarifies the preference factor.

As in other areas of Newfoundland, alder is likely the major factor in the positioning of beaver colonies in Terra Nova National Park (Northcott 1971, reported by Bateman et al, 1983). A lack of food is considered to be the major impetus to colony abandonment, although damage to dams and lodges by ice and spring floods can also cause the colony to move.

It might be said that beavers have had in their choice of colony sites an ability to interact negatively with a number of established visitor facilities; including a roadway, a day use area, and at least one trail. The Conservation Plan will address this subject in greater detail.

Muridae (Rats, Mice and Voles)

There are four species present in the park; in this group, two, the Meadow Vole and the Muskrat, are native; and two, the Norway Rat and House Mouse are classed as accidental introductions.

Meadow Vole - Preferred habitats in the park, and elsewhere in Newfoundland appear to be grassy areas, edges of alder thickets, coastal heaths, and birch with a ground cover of kalmia and forbs (Bateman et al, 1983).

Cycles in vole population, with peaks every three to four years have been well documented elsewhere, but are yet to be confirmed for Newfoundland.

Voles have not been captured at as high a rate as shrews in small mammal trapping programs. In 1979, for example, 3,000 trap-nights yielded 120 shrews and 22 voles (Roscoe, 1980). It appears that voles are more restricted in numbers and in habitat than are shrews (Roscoe, 1980). Table VIII-8 shows catch per 100 trap-nights of meadow vole in Terra Nova National Park as compared to three other national parks in the Atlantic Region. While not yet confirmed in a quantitive manner, there is evidence that vole numbers are high on some offshore islets, where vegetation of a sedge/grass type is prolific, in part as a result of fertilization provided by colonially nesting terns and other seabirds. Utilization of Kalmia-Birch stands by high populations of voles, at least at certain times of the year, is not consistent with other studies (See Table VIII-5).

Voles serve as prey for most meat eating birds and mammals, particularly the weasel, marten, red fox and lynx.

Common Muskrat - This species is considered hypothetical in the park because no confirmed observations were made during the mammal survey; however, there have been sightings during the summer of 1981, at Southwest Brook (Wardens Baird and Mercer, personal communication), and Yudle, Trout and Pine Hill Ponds (Warden Tucker). Obviously, more work should be done.

Table VIII-8

Catch per 100 Trapnights of Meadow Vole in a Variety of Vegetation Types at Four National Parks in the Atlantic Provinces.

Habitat	Terra Nova	Gros Morne	Cape Breton Highlands	Fundy
Grassy-wet	0.5	1.6	3.6	0.0
Grassy-dry	0.0	not sampled	0.6	2.4
Balsam fir-moss	0.5	1.0	not sampled	not sampled
Other woodlands	0.0	0.1	0.2	0.2
Bogs and barrens	0.0	0.7	0.4	0.5

To become well established in an area, muskrats need standing bodies of water that do not freeze to bottom in winter, and that contain adequate amounts of aquatic vegetation. Over much of Newfoundland, it appears that muskrat numbers are depressed by efficient predation by mink. This may be the situation at the park as well (Bateman et al, 1983). The muskrat's apparent plight should be addressed in future studies.

Both the Norway Rat and the House Mouse are classified as uncommon in the park, and both species are very restricted within the park area, being found only around buildings and in the vicinity of wharves.

Canidae (Wolves, Dogs, Foxes)

The Arctic Fox is only a casual visitor to Insular Newfoundland as a traveller on the south drifting ice pack of the Labrador Sea. The greatest likelihood of its occurrence is in late winter or early spring.

The Red Fox is a rare resident of open habitats or edges. Although it will utilize most habitat types, it is most likely along the edges of bogs, barrens, and man-influenced areas. This species is observed much less often than the Lynx (Roscoe, 1978 and Wildlife Card Observation Reports, 1978 and onwards).

Ursidae (Bears)

The Black Bear is a wide-ranging animal found in suitable habitat throughout the park. Berry patches are favoured in late summer, and the dump near the north boundary of the park is frequented during the evenings throughout the visitor season. During recent summers there have been consistently 4-6 animals present at the dump most evenings, but numbers of up to nine bears have been noted simultaneously on other occasions. Bears occasionally frequent campgrounds looking for handouts or unguarded foodstuffs.

A tabulation of wildlife observation cards is as follows:

Year	Observations
1978	17
1979	64
1980	40
1981	--
1982	28

These figures show no particular trend, except that bears are regularly seen in the park.

The Polar Bear reaches Insular Newfoundland in the same way as the Arctic Fox. As was demonstrated in the vicinity of the town of Gander in 1981, any Polar Bear migrating inland from its coastal landfall is likely to be dispatched promptly. (Most authorities consider such a large carnivore too potentially dangerous to permit its free movement.)

Mustelidae (Weasels)

Three of the four species in this group are native to Insular Newfoundland; the weasel, the marten and the otter. The mink is the only introduced mustelid.

The Weasel (ermine) uses a variety of vegetation types, but prefers coniferous or mixed wood types. In search of food, it will successfully capture prey many times its own size; everything from the Meadow Vole to the Snowshoe Hare, including a number of species of birds (Northcott, 1974).

The Mink is often observed in Terra Nova National Park, as it seems to have a particular attraction to park wharves, where people too are regular visitors. Mink are associated with most water bodies in the park, but expecially along the coast. The first Mink were imported from Nova Scotia to Newfoundland for the purpose of stocking fur ranches in 1934. Escapes from various ranches, plus the deliberate introduction of 13 silver-blue mink of three subspecies to Swale Island in 1948, account for the current population of these animals in the park. Like other mustelids, the mink is an opportunist in its search for prey, and as it is an adept swimmer, as well as being agile on land, it takes fish, a variety of birds, muskrats (when available), and snowshoe hares.

Although it undoubtedly formerly occurred in the area now occupied by the National Park, the Pine Marten is now considered extirpated from the area. A "gentle release" form of re-introduction was planned for 1982, when four live-trapped animals from the South West Brook area of Newfoundland's west coast were set free on a site at the west end of Dunphy's Pond. The current site is at Ochre Hill, where four or more animals are scheduled for release in 1983.

The Pine Marten population has been greatly reduced in Newfoundland for the same reasons that caused its population to drop throughout its range in North America; i.e., overtrapping and reduction of its preferred habitat type which is mature to over-mature conifer forest. This latter type is judged to be the potential preferred habitat in Newfoundland.

Preferred foods of the Pine Marten are Meadow Vole and the Snowshoe Hare; however, a great number of items will be taken seasonally and when available. Some subsidiary food items include birds, berries and carrion.

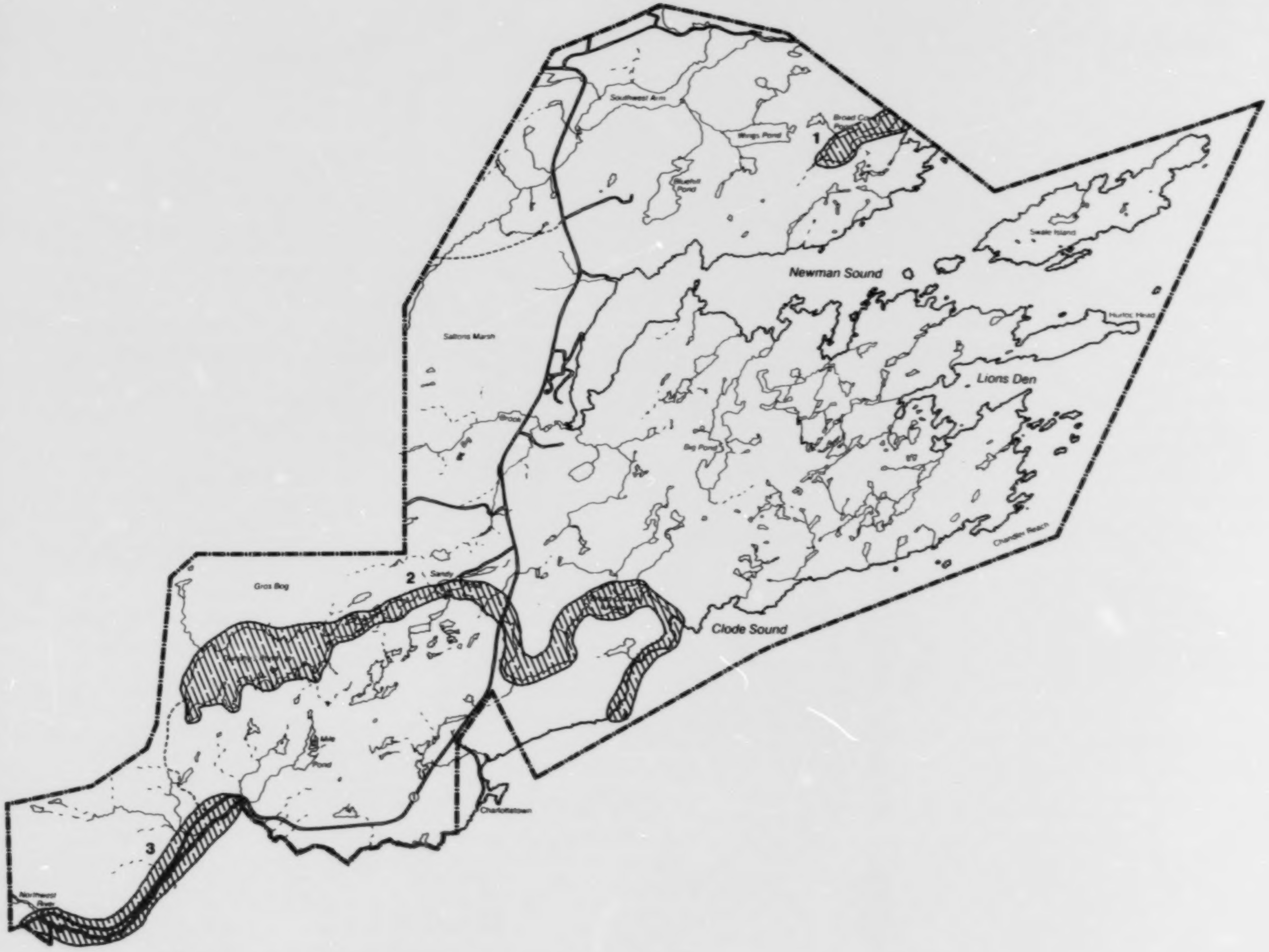
Otter are considered common in Terra Nova National Park; certainly there appears to be considerable ideal habitat, and ample food along the coast. Several areas in the park which are (or have been in the past) good areas to encounter this species are North Broad Cove, Bread Cove Brook and the coastline of Clode Sound, west of Charlottetown (See Map VIII-2).

Of great concern to the Resource Conservation staff is the ease at which legal, or quasi-legal trapping of the otter may take place near boundaries. This comment refers particularly to underwater sets placed in tidal water.

Family Felidae

The Lynx is considered an indigeneous Newfoundland mammal; however, it may have arrived on the Island from Labrador as recently as 1885 (Bateman et al, 1983). It is interesting to note that there was a population boom of these animals on the Avalon only a comparatively few years after this date in 1900-1910.

Terra Nova National Park


Southwest Arm
Wings Pond
Broad Cove Pond
1
Bluehill Pond
Swale Island
Newman Sound
Saltons Marsh
Hurloc Head
Lions Den
Brook
Big Pond
Chandler Reach
Gros Bog
2
Sandy
Clode Sound
Mile Pond
Charlottetown
3
Northwest River

MAP VIII-2

Otter Distribution
In
Terra Nova National Park

1. North Broad Cove
2. Dunphy's Pond - Bread Cove Brook Drainage System
3. Shoreline from Tidewaters to the Mouth of Northwest River

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

Lynx are regularly observed by park staff and visitors alike. They may be considered "common", especially when and where a favoured prey, the Snowshoe Hare, are in good numbers. Typical ecosystems are edges of fens, barrens and bogs, dense coniferous forest and edges of man-disturbed areas. As is to be expected in respect to declining hare numbers, the number of lynx observations in 1981 was noticeably down. It has also been noted on some occasions that lynx seem to be very "tame", a fact that may relate to infrequent exposure to humans.

Family Cervidae

In 1904, a successful introduction of Moose to Newfoundland, based on four animals from New Brunswick, took place at Howley. The first moose seen on what is now the park area was at Minchin's Cove in 1930. Moose were considered well-established in the park and over much of Newfoundland by 1936.

Aerial surveys since 1969, and including the most recent in February, 1982, indicate a declining population (See Table VIII-9). The successional trend of vegetation apparent in the park is responsible for this decline. Browse surveys in 1979, with remeasurement in 1982, indicate a shortage of high quality winter moose food in the park. Preferred winter yarding areas are indicated on Map VIII-3.

Table VIII-9

Summary of Aerial Moose Surveys Conducted in
Terra Nova National Park, Newfoundland - 1969-1982

	1969	1970	1971	1972	1973
Dates of Survey	Feb. 25, 26, 28	Jan. 19, 20	Jan. 29,30	Jan. 18,19,22	Feb. 5, 6
Days Since Snow	N/A	N/A	N/A	0 to 1	N/A
Snow Depth on Ground *1	Patches (-)	12.6"(10")	13.5"(15")	9.8"(9")	Patches (-)
Aircraft	Cessna 180	Bell CF-PHG helicopter	Hiller 12V helicopter	Bell CF-JF(F4) helicopter	helicopter
Total Air Hours	10h 30m	5h 35m	N/A	9h 35m	8h 55m
Height Above Ground	400'	300'	200' - 300'	200' - 300'	400'
speed (mph)	80-100	40-45	60	60	60
Method	Orbitting (Selected Strip) *2	Random Flight Lines	Transects	Transects	Transects
Area of Observation (both sides)	800'*3 (0.15 mi)	1200' (0.23 mi)	660' (0.125 mi)	660' 0.125 mi)	1000' (0.189 mi)
Length of Lines Flown	not done	170.75	360	323	323
% Coverage	100	25.7	29.4	26.4	40
Animals Observed	64	46	21	44	64
Animals/153 sq. mi.	64	179	71	168	160
Animals/sq. mi.	0.42	1.17	0.47	1.10	1.05

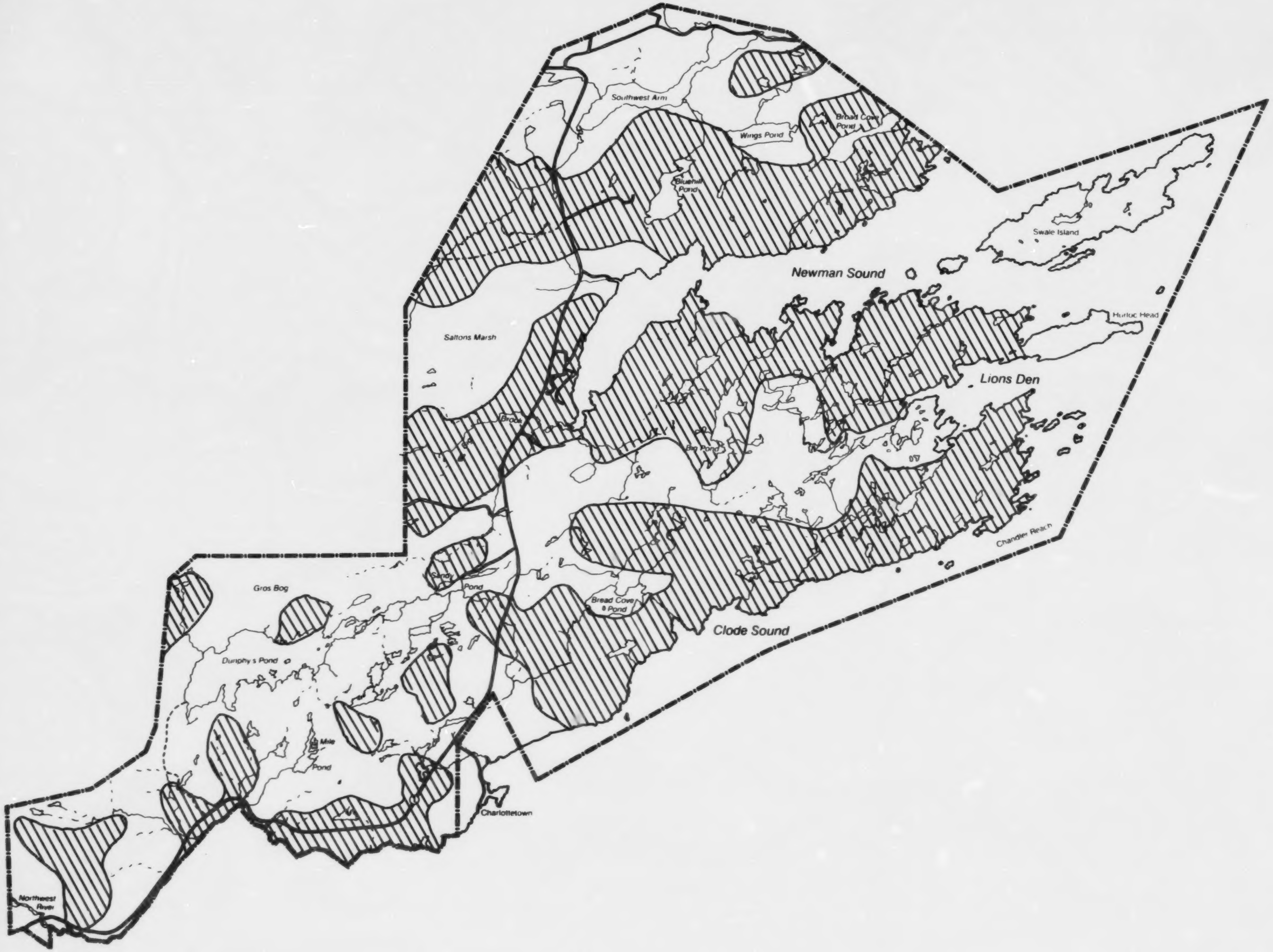
1* Inland Waters Branch Data (Warden Report Data in Brackets)
2* West of Trans Canada Highway
3* Seven transects only
Data from Roscoe, (1980) and Wardens Reports, (1982).

Table VIII-9 (Contin.)

	1969	1975	1977	1978	1982
Dates of Survey	Feb. 11, 12	Jan. 15, 16	Feb. 11, 12	Jan. 30, Feb. 1, 2	Feb. 9
Days Since Snow	N/A	N/A	3	N/A	1/2
Snow Depth on Ground *1	-(26")	24.8"(-)	20"(25")	12.6"(-)	-(2.8")
Aircraft	Beaver	Jet Ranger helicopter	Jet Ranger helicopter	Jet Ranger helicopter	Jet Ranger helicopter
Total Air Hours	5h 35m	10h 4m	7h 50m	12h 18m	6h 30m
Height Above Ground	600'	400'	400'	400'	300'
Speed (mph)	80-100	60	40	60	60
Method	Transects	Transects	Transects	Transects	Transects
Area of Observation (both sides)	1320' (0.25 mi)	1056' (0.20 mi)	1056' (0.20 mi)	1056' (0.20 mi)	1056' (0.20 mi)
Length of Lines Flown	323	323	323	323	323
% Coverage	53	42	42	42	42
Animals Observed	58	35	34	29	11
Animals/153 sq. mi.	110	83	80	69	35
Animals/sq. mi.	0.72	0.54	0.52	0.45	0.22

1* Inland Waters Branch Data (Warden Report Data in Brackets)
2* West of Trans Canada Highway
3* Seven transects only
Data from Roscoe, (1980) and Wardens Reports, (1982).

Terra Nova National Park


Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
Newman Sound
Saltons Marsh
Hurloc Head
Lions Den
Brook
Big Pond
Chandler Reach
Gros Bog
Sandy Pond
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
Northwest River

MAP VIII-3

Winter Moose Distribution
Based On Aerial Surveys
(1969-1982)
In Terra Nova National Park

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

Mortality of moose as a result of vehicle/moose collisions on the Trans Canada Highway is a continuing problem, (Table VIII-10), and of particular concern when it is noted to be remaining at high levels in the face of falling resident populations.

Table VIII-10

Moose Killed by Vehicles
On the Trans Canada Highway
In Terra Nova National Park 1969 - 1982*

1982 - 16
1981 - 14
1980 - 11
1979 - 11
1978 - 7
1977 - 9
1976 - 14
1975 - 4
1974 - 10
1973 - 13
1972 - 5
1971 - 11
1970 - 15
1969 - 18

* (Source, Roscoe, 1980)
(Tucker, 1982)

The Caribou is not at the present time a permanent resident in the park, although it has been in the past, at a time when there was less human disturbance, and improvements such as roads. In recent years Caribou might be considered as periodic visitors to the Pitts Pond and Terra Nova Lake areas, and could be very rare visitors to the Gross Bog area on the western boundary of the park (as recorded in the fall of 1982 by a resident of Terra Nova Village).

Marine Mammals

This group was not included in the mammal study, so as a result our information is very general. Among the whalebone whales only the Piked/Minke occurs with any regularity. There are few records for Finback and Sei and at least one record near the park of the very rare Blue Whale. When conditions are right, i.e., when squid are plentiful, Humpback Whales may appear in some numbers (1979 was the last such year). A Bowhead Whale and a Right Whale (Greenland) were reported near park waters in 1981 at Cape Bonavista.

Among Dolphins and Porpoises, the Pilot Whale or Pothead and the Harbour Porpoise are seen each year, and may at times be quite common. Dolphins that are regularly observed are the Saddleback/Common Dolphin, the White-beaked Dolphin or "Squidhound", and the Atlantic White-sided Dolphin or Jumper.

Among the seals, the Harbour Seal is more or less regular, and the Harp and Hooded Seals occur seasonally on spring ice. Gray Seals seem most likely in summer. There isn't much we can say in a definitive manner concerning the Ringed or Bearded Seal. The Walrus (Obodenus rosmarus), is not listed;

however, it would seem a possible visitant to park waters, as would the Narwhal, (Monoden monocerus). This latter species has been reported from Newfoundland waters (Halls Bay, Notre Dame Bay), in recent times.

It is theorized that the number of mammals that occupy oceanic islands is directly related to the distance of the island from the mainland, but other factors also affect the ease of island colonization by terrestrial mammals. The direction and strength of water currents, and the abundance of floating ice and debris rafts, for example, influence the probability that a species may accidentally drift to an island or successfully swim there. The nature of the current through the Strait of Belle Isle makes colonization from Labrador difficult since the Labrador Current flows south along the coast of Labrador and a northern flow passes close to the west coast of Newfoundland.

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Section IX

AVIFAUNA

A total of 170 species have been recorded within Terra Nova National Park boundaries and a further 58 species have been noted close enough to suggest irregular occurrence in the park. Sixty-three species are confirmed as breeding species and another 25 are widespread enough in summer to make breeding in the park extremely likely (Burrows, 1981). A full list of birds observed in the park and surrounding communities together with specific levels of abundance on a seasonal basis and preferences for particular habitats are given for each species recorded in Terra Nova National Park in Chart IX-1. The status of many species shows considerable seasonal variation, especially among migratory species. Thirty-one species are considered abundant during some part of their stay in Terra Nova National Park, while 19 species are listed as vagrants (Burrows, 1981). The greatest proportion of species are uncommon to common summer residents in the park.

Migration Pattern and Habitat Characteristics

Since most species occurring in the park are migratory, there is a pronounced seasonal migration in spring and fall. A few early migrants appear in early April, but most species arrive in the park in early to late May. Most birds probably reach Newfoundland at the southwest coast after a brief ocean crossing from Cape Breton, although some birds are known to make long ocean crossings. From there migration continues north and east over the island portion of the Province.

Symbols and Abbreviations Used in Chart IX-1

SUMMER STATUS

b= confirmed breeding in Terra Nova National Park
p = suspected breeding in Terra Nova National Park

STATUS AND ABUNDANCE

R = year-round resident
V = vagrant
W = winter resident (WINTER - November 15 - April 15)
SM= spring migrant (SPRING - April 15 - June 15)
S = summer resident (SUMMER - June 15 - August 15)
FM= fall migrant (FALL - August 15 - November 15)
a = seen on all visits
c = seen on most visits
u = seen on most visits
r = seen on very few visits
v = unlikely to be seen

MAIN PERIODS OF OBSERVATION

=========	period during which the species is most likely to occur on a regular basis.
--------	period during which the species is likely to occur on an irregular basis

MAJOR HABITATS

Pe - pelagic; open oceans and sounds
In - inshore; inner sounds and bays
Ma - margins; shorelines, flats, lake margins and marshes
Fe - fens; areas of interrupted drainage such as bogs and fens
Ba - barrens; heath and rock barrens, usually on higher ground
Se - second growth; thickets, new growth and tuckamore
De - deciduous; hardwoods and mixed woods with birch and maple
Co - conifers; softwood forests of spruce and fir with few birches

MAJOR SITES (Bracketed Code = Ecosections)

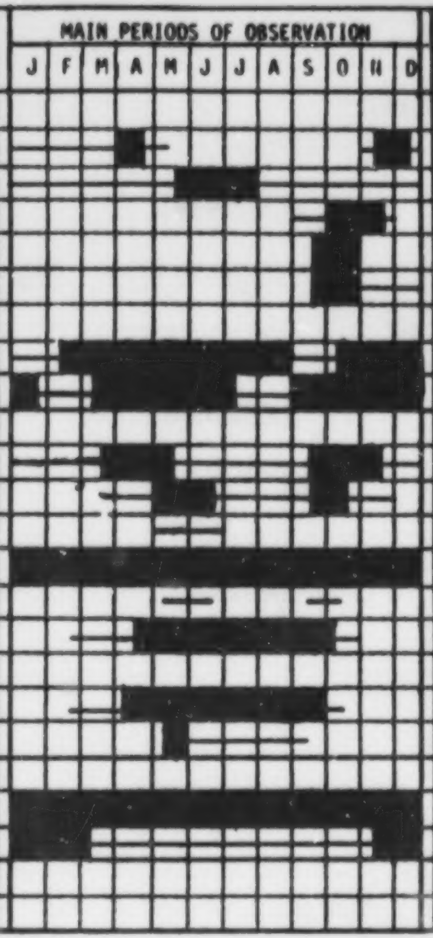
1. Louil Hills-Burnt Point (A1/D1)
2. Southwest Arm (A2/F1)
3. Blue Hill Trails (A4/A5)
4. Salton's Brook and Barachois (A6/F6)
5. Inner Newman Sound Coastal Trail (A12/F7)
6. Big Brook Flats & Inner Newman Sound (A12/F8)
7. Ochre Hill-Bread Cove (D11/D13/D18)
8. Sandy Pond-Beaver Pond (A19/B1)
9. Clode Sound Beaches (A17/B4)
10. Dunphy's Pond (A17/B1)
11. Swale Island & Outer Newman Sound (E2-4/F)
12. Copper Island (F21)
13. Lion's Den (E4-6/F21)
14. Outer Clode Sound (E6/F23/F25)

Chart IX-1

Status and Abundance, Main Periods of Observation, Major Habitats, and Major Sites for Species of Avifauna Seen in Terra Nova National Park

ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	MAIN PERIODS OF OBSERVATION												MAJOR HABITATS								MAJOR SITES
		J	F	M	A	M	J	J	A	S	O	N	D	Pe	In	Ma	Fe	Ba	Se	De	Co	
GAVIIFORMES																						
bCommon Loon	rW uSM cS cFM	—	—	—	■	■	■	■	■	■	■	■	■	X	X							6,9,10,13
Redthroated Loon	vW rFM													X	X							11
PODICIPEDIFORMES																						
Rednecked Grebe	vW vSM vFM	—	—	—							—	—	—	X	X							11,14
PROCELLARIIFORMES																						
Northern Fulmar	vS rFM													X	X							11,12,14
pLeach's Storm-petrel	uSM rS rFM				—	■	■	■	■	■	—			X	X							6,9,11,12
PELECANIFORMES																						
Northern Gannet	vSM uS rFM				—	■	■	—	—	—				X								11,12,14
pDoublecrested Cormorant	cSM aS uFM				—	■	■	■	■	■				X	X							1,2,10,13
CICONIIFORMES																						
pAmerican Bittern	rSM rS vFM				—	■	■	■	■	—						X	X					2,8
ANSERIFORMES																						
bCanada Goose	uW cSM uS aFM			—	■	■	■	■	■	■	■	■	■		X	X	X					6,10
Mallard	vW vFM									■	■	■	■		X	X						6
bBlack Duck	aW aSM cS aFM	■	—	—	■	■	■	■	■	■	■	■	■		X	X	X					2,6,8,9
Pintail	vSM vFM									■	■											6,9
bGreenwinged Teal	rSM rS rFM	—	—	—	—	■	■	■	■	■	■	■	—			X	X					6,11,13
Northern Shoveler	vSM															X						6
bRingnecked Duck	rSM uS rFM					■	■	■	■	■	■					X						6,7,8
Greater Scaup	rW vSM rFM	■									■	■	■	X	X							11,14
Lesser Scaup	vW vFM														X	X						6
bCommon Goldeneye	aW uSM rS aFM	■	■	■	■	■	■	■	■	■	■	■	■	X	X	X						1,6,13
Barrow's Goldeneye	rW vSM	■	■	■	—	—						■	■									1,6
Bufflehead	uW	■	■	■								■	■		X							1

Chart IX-1 (Continued)



ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	MAJOR HABITATS Pe	In	Ma	Fe	Ba	Se	De	Co	MAJOR SITES
bOldsquaw	rW vSM vS	X								11,12,13,14
Harlequin	vW vSM vFM	X	X							1,6
bCommon Eider	rW rSM uS rFM	X	X							11,12,14
Whitewinged Scoter	vW vSM rFM	X	X							1,6,13
Surf Scoter	uFM	X	X							6
Black Scoter	vW uFM	X	X							6,13
Hooded Merganser	vFM		X	X						6
bCommon Merganser	uR		X	X						1,2,6,9
bRedbreasted Merganser	aW cSM uS aFM	X	X	X						1,2,4,6,9
FALCONIFORMES										
bGoshawk	rR				X	X	X		X	3,5,7,8
pSharpshinned Hawk	rW rSM vS uFM						X	X		1,2,8
Roughlegged Hawk	vW vS vFM				X	X				7
bBald Eagle	cR		X	X						1,4,6,9,11,13
Northern Harrier	vW rSM vS vFM			X	X	X				4,7
bOsprey	vW cSM aS rFM		X	X	X					1,3,6,7,9,13
Gyrfalcon	vW		X	X						11,14
bMerlin	vW cSM cS uFM			X	X	X			X	1,3,5,7
American Kestrel	rSM vS rFM				X	X	X			2,5,9
GALLIFORMES										
bRuffed Grouse	aR						X	X	X	2,3,4,5,9,10
bWillow Ptarmigan	aW uR				X	X				7,9
GRUIFORMES										
Corn Crake	vV			X						9

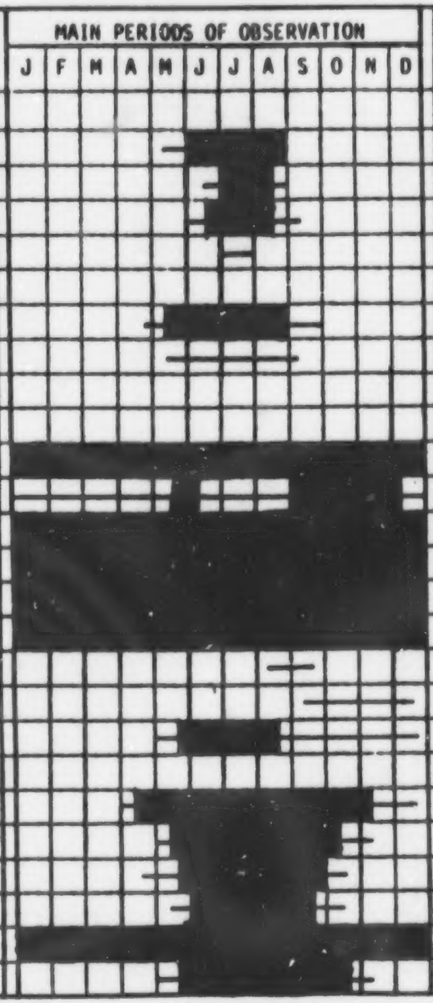
Chart IX-1 (Continued)

ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	J	F	M	A	M	J	J	A	S	O	N	D	Pe	In	Ma	Fe	Ba	Se	De	Co	MAJOR SITES
CHARADRIIFORMES																						
Semipalmated Plover	uS cFM								■	■	■					X						1,6,9
Killdeer	vV															X						6
American Golden Plover	vFM															X	X	X				6,7
Blackbellied Plover	uS cFM								─	■	■					X						1,4,6,9
Ruddy Turnstone	vS rFM															X						4
American Woodcock	vSM rFM									■	■					X	X		X			1,2,9
bCommon Snipe	cSM cS uFM					■	■	■	■	■						X	X					1,2,4,6,7,8
bSpotted Sandpiper	aSM aS cFM						■	■	■	■						X						1,2,4,6,8,9
Solitary Sandpiper	vV															X						2
bGreater Yellowlegs	aSM cS aFM					■	■	■	■	■	■					X	X					1,2,4,6,8,9
Lesser Yellowlegs	vSM vS rFM								─							X						4,6
Spotted Redshank	vV															X						6
Purple Sandpiper	rW														X							11,12,14
Pectoral Sandpiper	vS vFM															X						1,6
Whiterumped Sandpiper	vW uFM								─	─	■	■			X	X						1,4,6,9
Baird's Sandpiper	vV															X						9
pLeast Sandpiper	uS cFM							─	■	■						X	X					1,4,6,9
Shortbilled Dowitcher	rS vFM							─	─							X						6
Semipalmated Sandpiper	vSM rS cFM							─	■	■	■					X						4,6,9
Sanderling	vFM									─					X	X						9
Glaucous Gull	rW	■	■	■								■	■	X	X							6,11,14
Iceland Gull	uW	─										■	■	X	X							6,11,14
bGreat Blackbacked Gull	aR	■	■	■	■	■	■	■	■	■	■	■	■	X	X	X						1,4,6,9,10,12
bHerring Gull	aR	■	■	■	■	■	■	■	■	■	■	■	■	X	X	X						1,4,6,9,14
Ringbilled Gull	vW uSM rS uFM	─	─		─	■	─			■	■	■	■		X	X						1,6

Chart IX-1 (Continued)

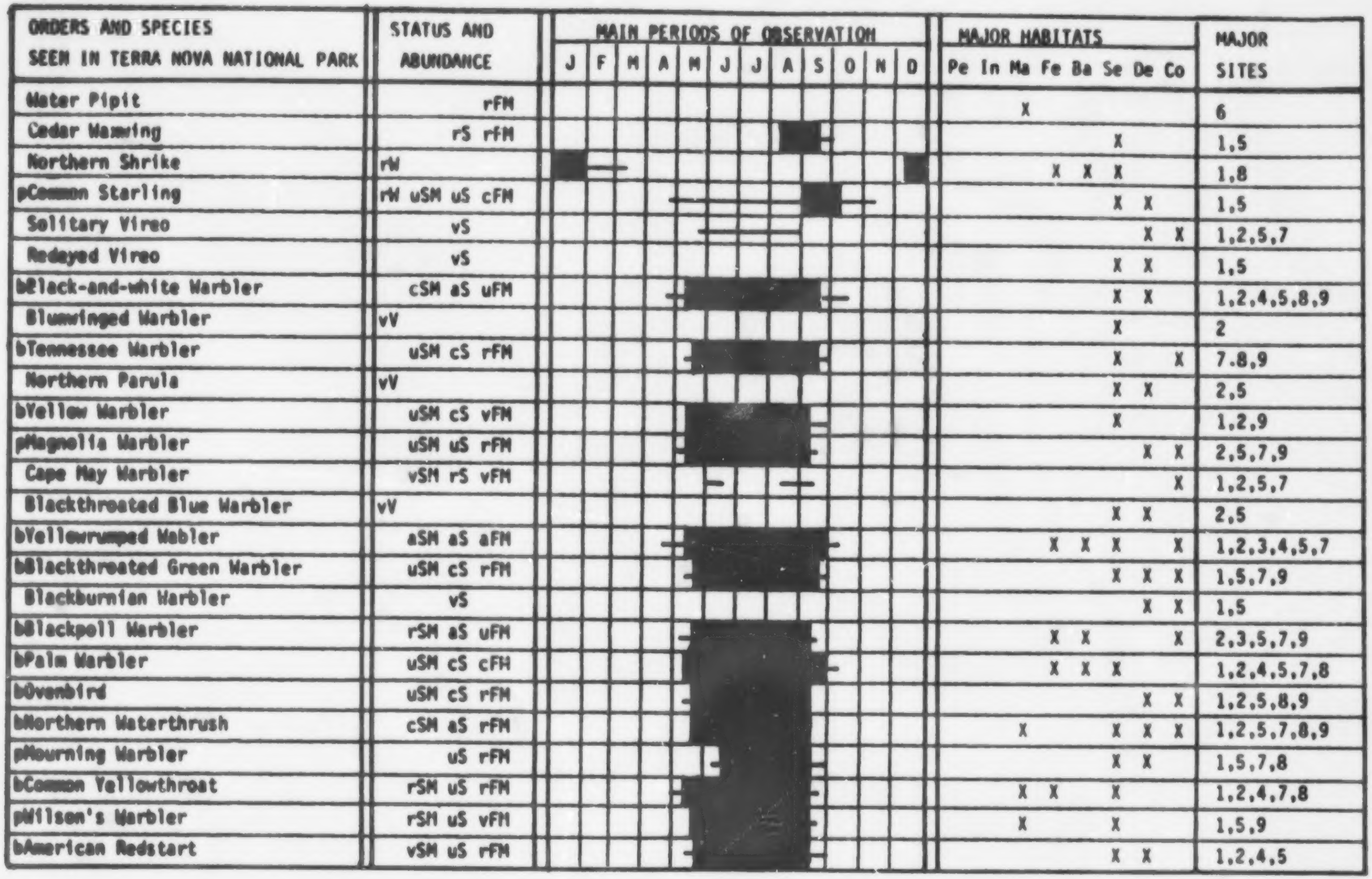
ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	MAIN PERIODS OF OBSERVATION												MAJOR HABITATS								MAJOR SITES
		J	F	M	A	M	J	J	A	S	O	N	D	Pe	In	Ma	Fe	Ba	Se	De	Co	
Blackheaded Gull	rW										—	—	—		X	X						6
Blacklegged Kittiwake	uW vSM rFM	■	■	■	—				—	—	—	■	■	X	X							6,11,12,14
bCommon Tern	cSM aS uFM					■	■	■	■	■	—				X	X						1,4,6,11,13
bArctic Tern	vSM uS rFM					■	■	■	■	■				X	X	X						1,4,6,11,13
Thinbilled Murre	uW rSM vS rFM												■	X	X							6,11,14
Thickbilled Murre	uW vSM vFM										—	—	—	X								11,14
Dovekie	uW rSM	■	■	■	■	—						■	■	X	X							11,13,14
bBlack Guillemot	u-cR	■	■	■	■	■	■	■	■	■	■	■	■	X	X							6,11,12,13
Common Puffin	vW vSM vS													X	X							11,14
COLUMBIFORMES																						
Rock Dove	rR																		X			1,9
Mourning Dove	vW vSM vS rFM									—	■	■	■			X			X			5,9
CUCULIFORMES																						
Blackbilled Cuckoo	vS																		X	X		5,8
STRIGIFORMES																						
bGreat Horned Owl	rR									■	■								X	X	X	2,3,5,7
Snowy Owl	vW vS vFM	—	—	—									—		X	X	X	X				12,13,14
pHawk Owl	vR																X				X	7,8
pBoreal Owl	rSM rS						■	■													X	5
CORACIIFORMES																						
bBelted Kingfisher	rW cSM aS uFM					■	■	■	■	■	—	—				X						1,2,4,5,8
PICIFORMES																						
bCommon Flicker	cSM aS cFM				—	■	■	■	■	■									X	X		2,5,8,9
Yellowbellied Sapsucker	vS																			X		5
bHairy Woodpecker	u-cR	■	■	■	■	■	■	■	■	■	■	■	■							X	X	2,3,4,5,8
bDowny Woodpecker	c-aR	■	■	■	■	■	■	■	■	■	■	■	■						X	X		1,2,3,5,8
bBlackbacked Threetoed Woodpecker	uR	■	■	■	■	■	■	■	■	■	■	■	■				X				X	2,3,4,6,7
Northern Threetoed Woodpecker	vR																X				X	7

Chart IX-1 (Continued)



ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	Pe	In	Ma	Fe	Ba	Se	De	Co	MAJOR SITES
PASSERIFORMES										
bYellowbellied Flycatcher	uSM aS				X		X		X	2,3,5,7,8
pAlder Flycatcher	rS vFM			X			X			1
pLeast Flycatcher	rS vFM						X	X		4,8
Olivesided Flycatcher	vS			X	X					5,8
Horned Lark	rSM vFM			X		X				7
bTree Swallow	uSM cS vFM			X	X	X	X			1,2,4,5,7,8
Bank Swallow	vS			X						1
Barn Swallow	vV			X						5,9
Cliff Swallow	vV			X						5
bGray Jay	aR				X	X	X		X	1,2,3,4,5,7,9
pBlue Jay	r-uR						X	X		5
bCommon Raven	aR		X	X	X	X			X	2,4,5,7,9,10
bCommon Crow	aR		X	X			X	X		1,4,5,8,9
bBlackcapped Chickadee	cR						X	X		1,4,5,8
bBoreal Chickadee	aR				X	X			X	2,3,4,5,7,10
Redbreasted Nuthatch	v-rR								X	5,9
pBrown Creeper	vR							X	X	3,4,5
Winter Wren	vW rSM vS vFM						X		X	5,7,9
Gray Catbird	vV						X			5
bAmerican Robin	uW aSM aS aFM						X	X	X	1,2,4,6,8,9
bHermit Thrush	uSM aS cFM								X	1,3,5,8
bSwainson's Thrush	uSM aS cFM						X	X	X	1,2,3,4,5,7
pGraycheeked Thrush	rSM cS rFM								X	1,3,7,8
bGoldencrowned Kinglet	cR						X	X	X	2,3,4,5,9
bRubycrowned Kinglet	cSM aS cFM				X		X		X	1,2,4,5,7,8

Chart IX-1 (Continued)



ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	Pe	In	Ma	Fe	Ba	Se	De	Co	MAJOR SITES
Water Pipit	rFM			X						6
Cedar Waxwing	rS rFM						X			1,5
Northern Shrike	rW				X	X	X			1,8
pCommon Starling	rW uSM uS cFM						X	X		1,5
Solitary Vireo	vS							X	X	1,2,5,7
Redeyed Vireo	vS						X	X		1,5
bBlack-and-white Warbler	cSM aS uFM						X	X		1,2,4,5,8,9
Bluewinged Warbler	vV						X			2
bTennessee Warbler	uSM cS rFM						X		X	7.8,9
Northern Parula	vV						X	X		2,5
bYellow Warbler	uSM cS vFM						X			1,2,9
pMagnolia Warbler	uSM uS rFM							X	X	2,5,7,9
Cape May Warbler	vSM rS vFM								X	1,2,5,7
Blackthroated Blue Warbler	vV						X	X		2,5
bYellowrumped Wabler	aSM aS aFM				X	X	X		X	1,2,3,4,5,7
bBlackthroated Green Warbler	uSM cS rFM						X	X	X	1,5,7,9
Blackburnian Warbler	vS							X	X	1,5
bBlackpoll Warbler	rSM aS uFM				X	X			X	2,3,5,7,9
bPalm Warbler	uSM cS cFM				X	X	X			1,2,4,5,7,8
bOvenbird	uSM cS rFM							X	X	1,2,5,8,9
bNorthern Waterthrush	cSM aS rFM			X			X	X	X	1,2,5,7,8,9
pMourning Warbler	uS rFM						X	X		1,5,7,8
bCommon Yellowthroat	rSM uS rFM			X	X		X			1,2,4,7,8
pWilson's Warbler	rSM uS vFM			X			X			1,5,9
bAmerican Redstart	vSM uS rFM						X	X		1,2,4,5

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Chart IX-1 (Continued)

ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	MAIN PERIODS OF OBSERVATION												MAJOR HABITATS								MAJOR SITES
		J	F	M	A	M	J	J	A	S	O	N	D	Pe	In	Ma	Fe	Ba	Se	De	Co	
pHouse Sparrow	rR																		X			1,5
Bobolink	vV																		X			5
Dickcissel	vV	—	—									—	—						X			1,5
Yellowheaded	vV															X						2,5
Northern Oriole	vV										—								X	X		1,2,5
bRusty Blackbird	uSM uS cFM				—	■	■	■	■	■						X	X					1,7,8
Common Grackle	vV															X			X			2,5
pBrownheaded Crow	rSM vS vFM				■	—	—	—	■							X	X		X			1,9
pRosebreasted Grosbeak	rS vFM							■	■	■	—								X	X		1,5
Indigo Bunting	vV																		X			1,5
pEvening Grosbeak	u-cR	—	—	—	■	■	■	■	■	—	■	■	—						X	X	X	1,2,5
pPurple Finch	rW cSM uS uFM				■	■	■	■	■	■									X	X		1,2,5
bPine Grosbeak	uR	■	■	■	■	■	■	■	■	■	■	■	■					X	X		X	3,5,7,10
Hoary Redpoll	vW	—	—	—									—					X	X		X	1,5
pCommon Redpoll	aW rSM uS uFM	■	■	■	■	■	■	—	—	—	■	■	■					X	X	X		1,2,5,9
Eurasian Siskin	vV																		X			2
bPine Siskin	c-aR	—	■	■	■	■	■	■	■	■	■	■	—						X	X	X	1,2,5,7,9,10
bRed Crossbill	u-cR	■	■	■	■	■	■	■	■	■	■	■	■							X	X	3,4,5,10
bWhitewinged Crossbill	r-uR	■	■	■	■	■	■	■	■	■	■	■	■				X				X	3,4,5,10
Grasshopper Sparrow	vV															X			X			5
pSavannah Sparrow	uSM uS rFM					■	■	■	■	■	—					X	X		X			1,5,7
bDarkeyed Junco	cR	—	—	—	■	■	■	■	■	■	■	■	■						X	X	X	1,5,7
Tree Sparrow	vW																	X	X			5,9
pChipping Sparrow	vSM rS vFM																		X		X	1,5

Chart IX-1 (Continued)

ORDERS AND SPECIES SEEN IN TERRA NOVA NATIONAL PARK	STATUS AND ABUNDANCE	MAIN PERIODS OF OBSERVATION												MAJOR HABITATS								MAJOR SITES
		J	F	M	A	M	J	J	A	S	O	N	D	Pe	In	Ma	Fe	Ba	Se	De	Co	
Whitecrowned Sparrow	vS vFM																	X	X			1,5,7
bWhitethroated Sparrow	vW cSM aS cFM					■	■	■	■	■	■								X	X	X	1,3,4,5,7,8
bFox Sparrow	vW cSM aS cFM				■	■	■	■	■	■	■							X	X			1,2,3,5,7,9
bLincoln's Sparrow	uSM aS uFM					■	■	■	■	■						X	X		X			1,2,7,8
bSwamp Sparrow	rSM cS uFM					■	■	■	■	■						X	X		X			1,2,6
Song Sparrow	vS															X			X			5
Snow Bunting	u-cW rFM	■	■	■	■						■	■	■			X		X				1,9

Many year-round residents begin nesting early in the spring before the migrants return and several have young in the nest when the first spring arrivals appear. This is particularly true of the birds of prey. Even the earlier arrivals are also well advanced in their nesting season when the last migrants appear in early June. Most species complete their breeding cycle in mid July and young of the year are an obvious feature of July and August.

Family parties gather at favoured areas late in the summer and this "gathering of the clans" is a prelude to fall migration. The order of departure is almost the reverse of the order of spring arrival, with the exception of certain thrushes (Turdidae) and wood warblers (Parulidae). Fall migration is generally more obvious than in the spring, although the final dates of departure are more difficult to record than the dates of arrival. This is partly because of the increase in numbers following breeding in the park, but also because several groups follow different migration routes in the fall. This is especially true of the shorebirds, which follow a mainly overland route west of the Province in spring, but change to a coastal and oceanic route in the fall.

Very few species overwinter in the park, but some northern species may appear as winter visitors. Their numbers are largely influenced by food availability further north and snow cover in the park area. Most birds are associated with open water or feeding stations, where a constant food source is available, but year-round residents less affected by changes in weather conditions are more widespread.

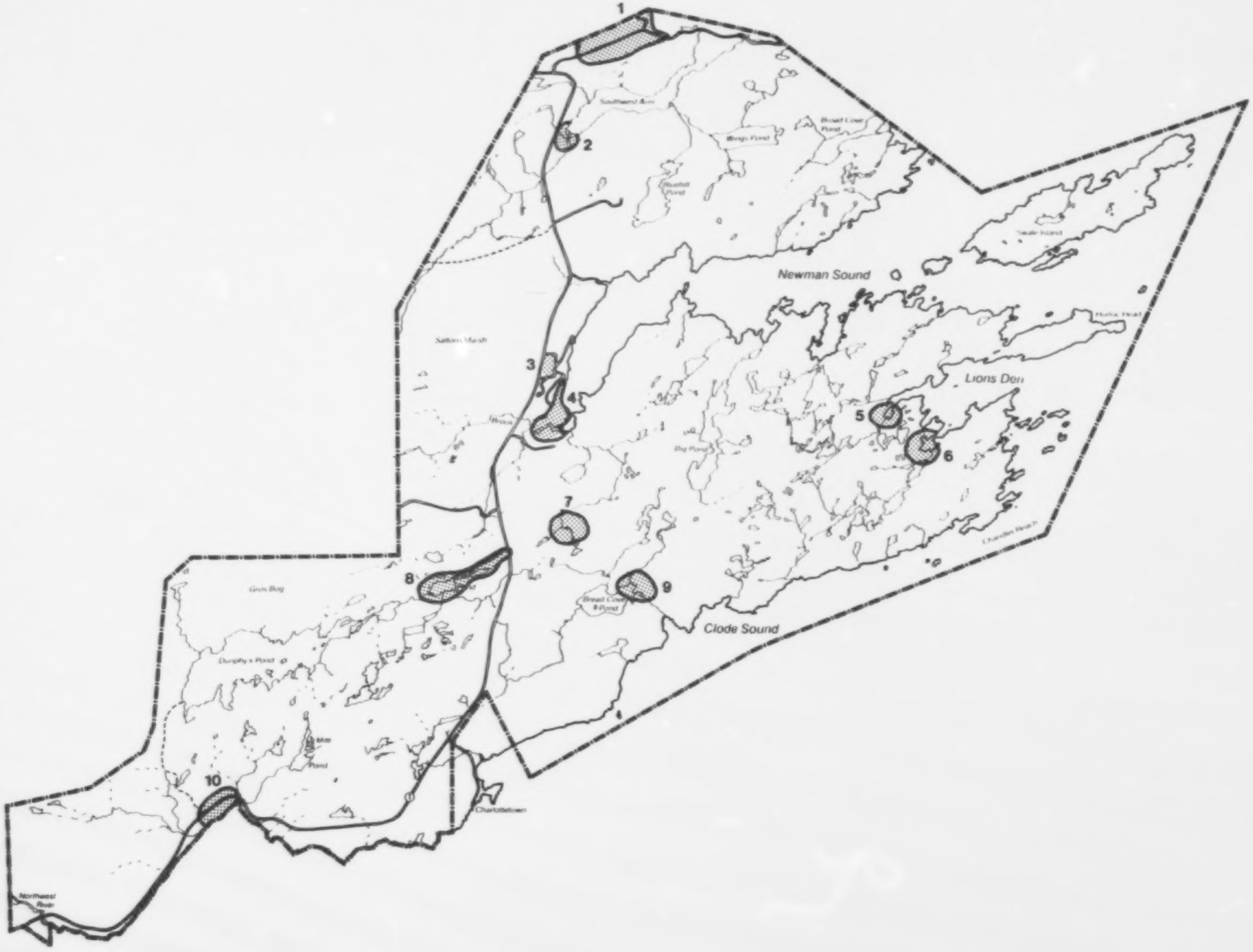
Certain habitats are more important to birds than others and this is reflected in the differences in breeding density and migration period concentrations found in the park. During the breeding season the distribution of most terrestrial species is relatively uniform but numbers are highest in the preferred habitats listed in Chart IX-1. The variety of nesting sites and foraging levels offered in mixed woods or transitional stages with abundant second growth makes this type of habitat the best place to see both an abundance and variety of species. Such areas exist at Burnt Point-Louil Hills and to a lesser extent in other parts of the park.

The least productive habitats are open bogs and rock barrens, but even here specialized species can be found. Areas of major importance for observing breeding birds are shown on Map IX-1.

During migration periods the availability and abundance of food become major considerations and the best areas for observation are found along the coast, where aquatic, marine and terrestrial insects are abundant. The best areas are those that combine open mixed wood and glade habitats with patches of thicket and second growth for passerines and expanses of mud flats and shallow brackish water for waterfowl, gulls and shorebirds. This combination occurs at Big Brook Flats and along the Inner Newman Sound Coastal Trail, where the greatest variety of species can be expected in spring and fall. Smaller estuaries at Southwest Arm and Tidewaters are also quite important during the migration periods, although numbers of all groups tend to be lower. These areas are very attractive to birds of prey at these times. Areas of major importance for observing spring and fall migrants are shown on Map IX-2.

In winter relatively few areas contain open water and the best birding is actually found outside park boundaries at

Terra Nova National Park


1
2
3
4
5
6
7
8
9
10
Southwest Arm
Wings Pond
Newman Sound
Swale Island
Lions Den
Big Pond
Bread Cove Pond
Clode Sound
Dunphy's Pond
Charlottetown
Northwest River

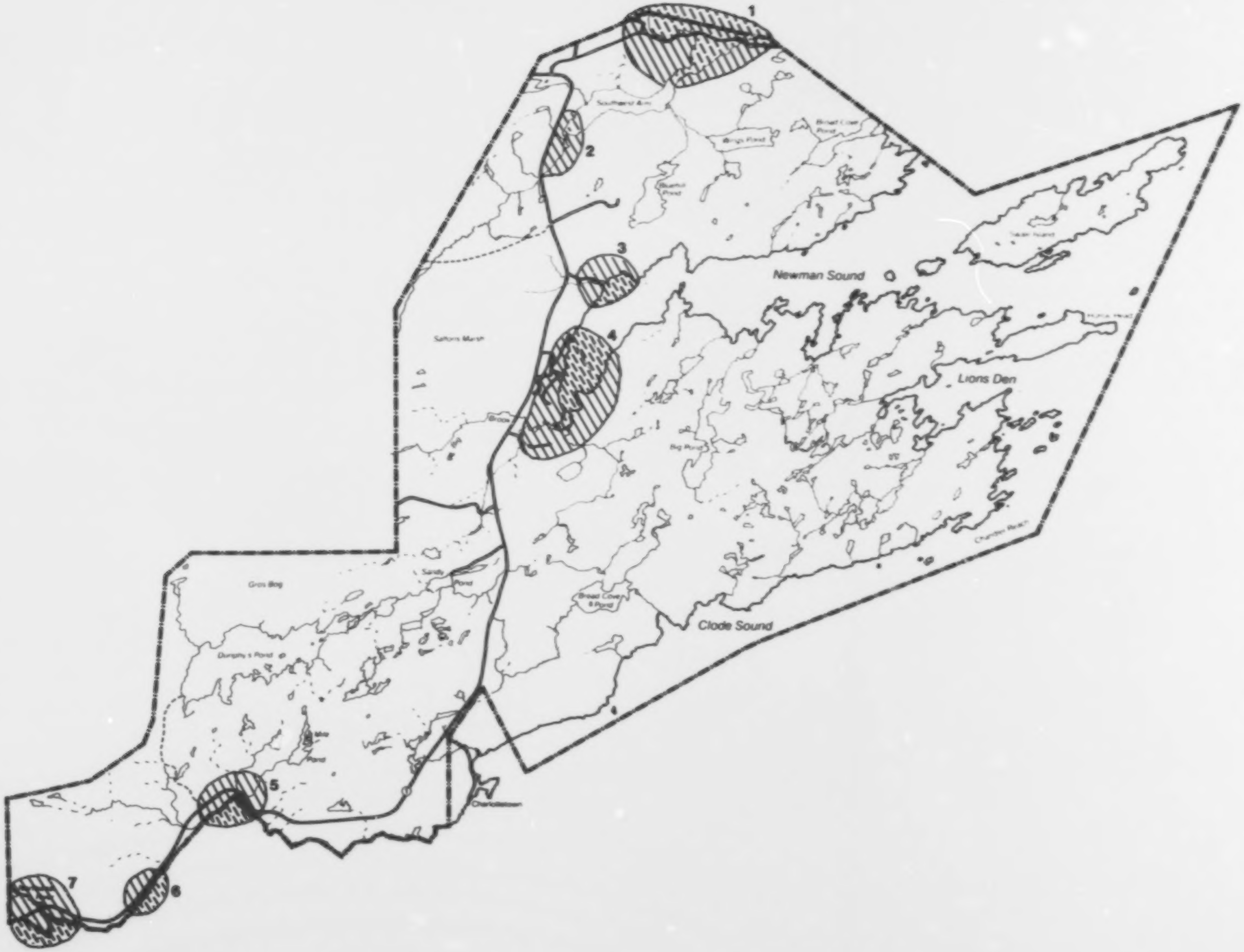
MAP IX-1

Important Areas For Observing Breeding Birds In Terra Nova National Park

1. Louil Hills Area
2. Inner Southwest Arm
3. Headquarters Area
4. Newman Sound Campground
5. Inner Lion's Den
6. Park Harbour
7. Ochre Hill
8. Sandy Pond - Beaver Pond
9. Outlet of Bread Cove Pond
10. Tidewaters

Parks Canada
Atlantic Region

Terra Nova National Park


1
2
3
4
5
6
7
Southwest Arm
Newman Sound
Lions Den
Saltons Marsh
Big Pond
Gros Bog
Sandy Pond
Bread Cove Pond
Dunphy's Pond
Mile Pond
Clode Sound
Charlottetown

MAP IX-2

Important Areas For Observing
Spring and Fall Migrant Birds
In Terra Nova National Park

1. Outer Southwest Arm - Eastport Causeway
2. Inner Southwest Arm
3. Salton's Wharf Area
4. Inner Newman Sound
5. Tidewaters
6. Cobblers Area
7. Northwest River including Terra Nova National Park Golf Course

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

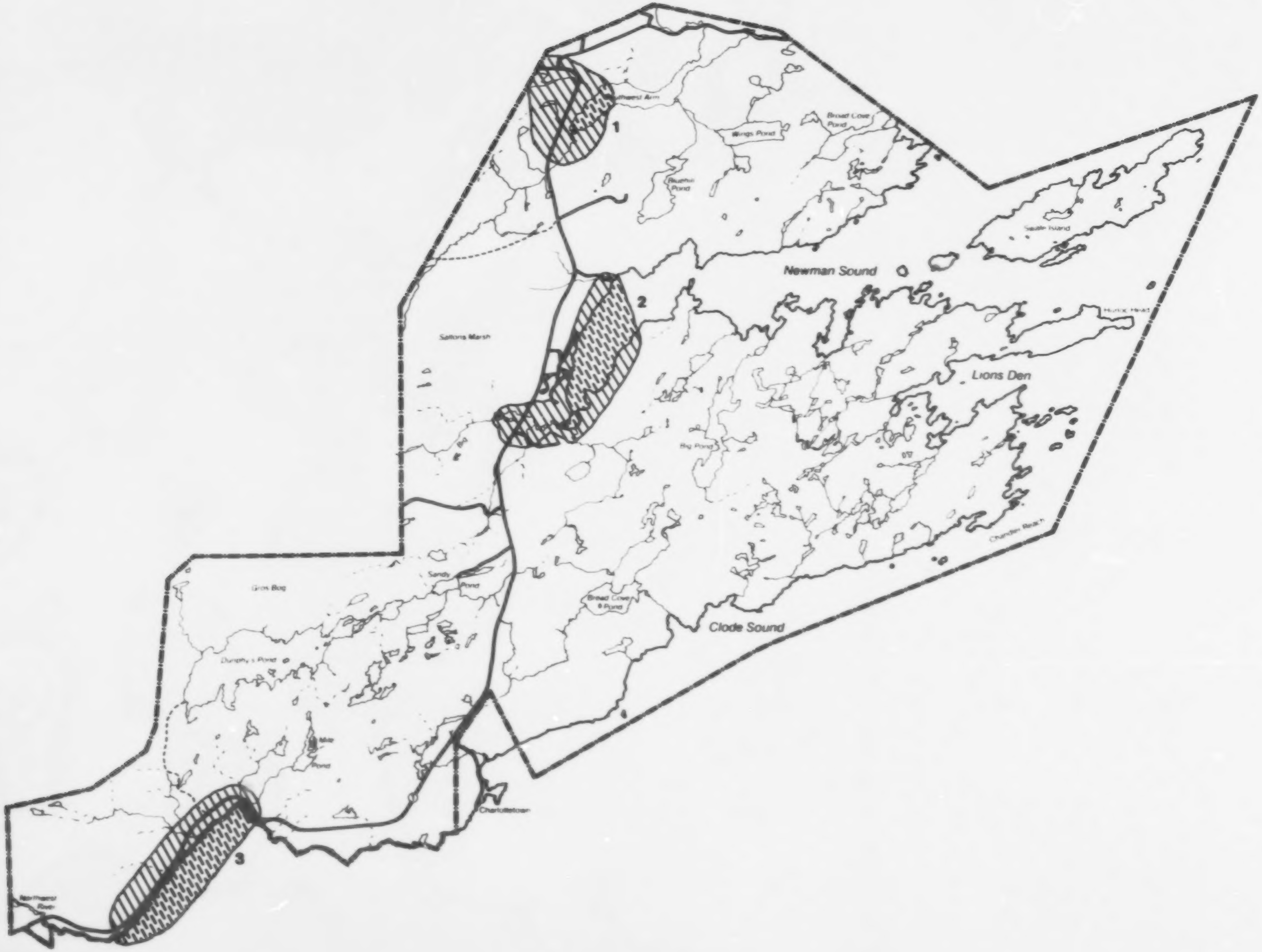
Traytown-Cull's Harbour and Happy Adventure-Sandy Cove. The Inner Newman Sound area does, however, attract overwintering waterfowl and occasional birds of prey and is quite productive until the first major freeze-up in early to mid January. Alder thickets along the Trans-Canada Highway and gravel pits just off the highway are favoured by wintering passerines. All these areas are given in Map IX-3.

Loons and Waterfowl of Terra Nova National Park

Terra Nova National Park has long been known as an excellent location for waterfowl throughout the year and recent studies have justified the designation of several areas of the park as International Biological Preserves. Since its creation in 1957, Terra Nova National Park has provided records of 24 species of waterfowl, including two species of loons and one species of grebe. Duck species are well represented in the park, with dabbling ducks and geese most common in the bays and fringing salt marshes and diving ducks and geese most common in the bays and sounds. In recent years there have been range extensions for several species throughout Atlantic Canada and this is reflected in the increased occurrence and addition of several species to the park list. Further additions are likely in the near future as four other species occur on a fairly regular basis in coastal eastern Newfoundland and could appear in the park at any time. The only unusual record is that of the southernmost breeding of Oldsquaw (*Clangula hyemalis*) at Copper Island in 1974.

Common Loon: This is the only member of its order breeding within the park boundaries, although the Redthroated Loon breeds on offshore islands to the north and south. Breeding ponds are inhabited from late May to mid August and the birds are most vulnerable to ground predators and human

Terra Nova National Park


Southwest Arm
1
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
Newman Sound
2
Sailors Marsh
Lions Den
Big Pond
Chandler Reach
Sandy Pond
Gros Bog
Broad Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
3
Northwest River

MAP IX-3

Important Areas For Observing
Wintering Passerines In
Terra Nova National Park

1. Eastport Junction - Inner Southwest Arm
2. Inner Newman Sound - Big Brook
3. Tidewaters Area

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

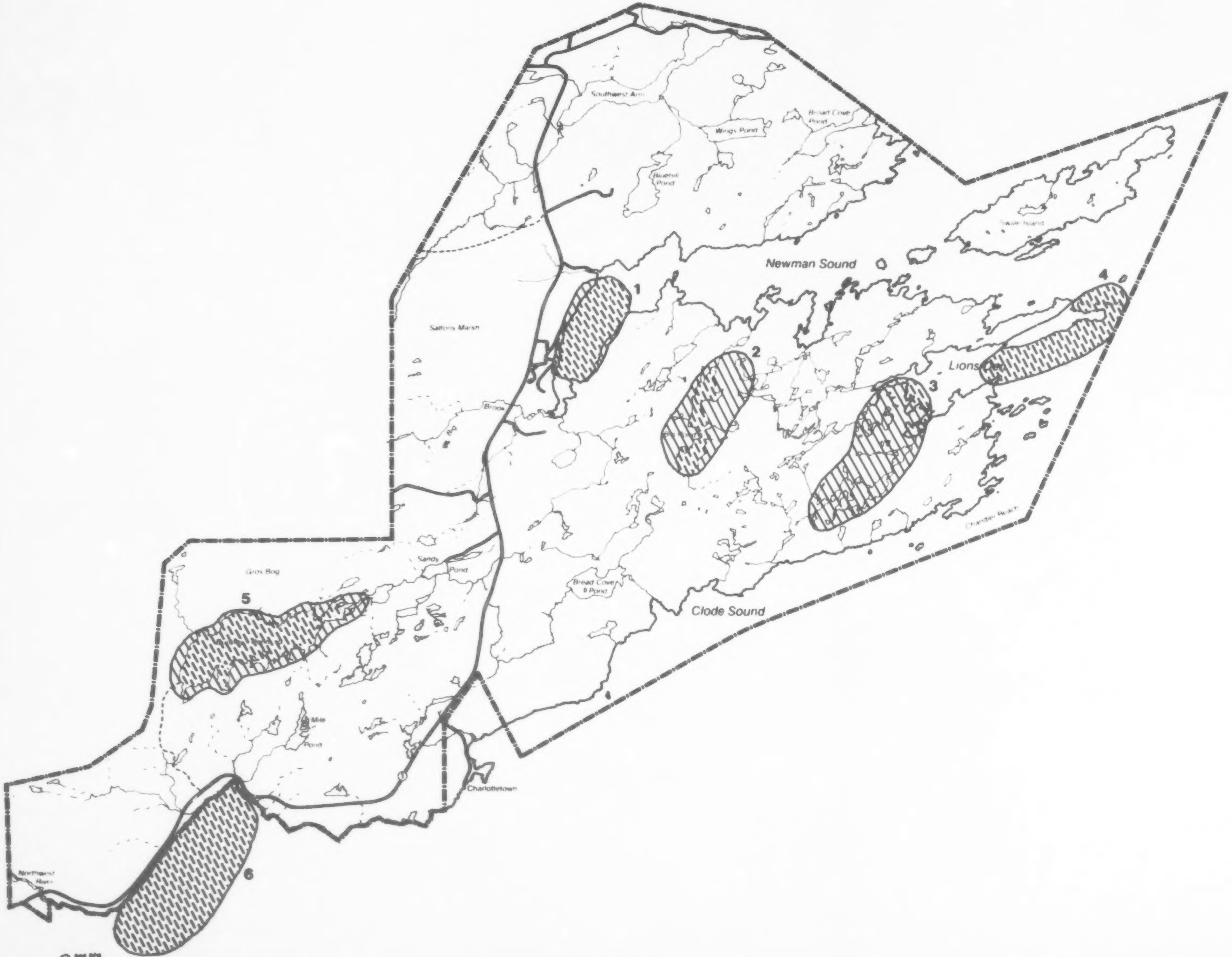
disturbance from May to early July, by which time the young are usually large enough to feed with the parents in open water. The greatest number of birds are present on saltwater from late September to late October. Map IX-4 indicates good areas for observing loons.

Canada Goose: The nominate race (B. c. canadensis) is a restricted breeder at Salton's Fen and Gross Bog and may occur on a more irregular basis at other less popular sites. Birds may breed in their third year and return to their natal home to maintain long term nest sites. Very few predators are a threat to this large race, but human disturbance can reduce breeding success. Park birds feed primarily on marine algae and eelgrass. Map IX-5 indicates areas of observation for geese and dabbling ducks.

Black Duck: This species has a very broad range of nesting habitats. Hybridization with the Mallard (Anas platyrhynchos) has produced a less adaptable genetic stock and the species is considered by many as a subspecies of the more widespread Mallard. Brackish estuarine bays are favoured in winter when animal matter forms a very high proportion of the diet. Pair formation starts in September and is complete by April when the first clutches are started. Broods are commonly seen in late May and predation by mammals is a greater problem for nesting birds than human disturbance.

Green-Winged Teal: The American subspecies (Anas crecca carolinensis) prefers small and shallow ponds near woodlands and needs abundant emergent vegetation during the summer. The major part of the diet consists of small plant seeds and pondweeds in summer, but small invertebrates, especially molluscs, are eaten on the tidal mud flats in fall and early

Terra Nova National Park



Southwest Arm
Broad Cove Pond
Wings Pond
Bluehill Pond
Newman Sound
Swale Island
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Saltons Marsh
Brook
Big
Big Pond
Lions Den
Chandler Reach
Sandy
Pond
Gros Bog
5
Bread Cove Pond
Clode Sound
Mile
Pond
Charlottetown
Northwest River
6

MAP IX-4

Important Areas For
Observing Loons In
Terra Nova National Park

1. Inner Newman Sound
2. Big Pond Area
3. Park Harbour Area Ponds
4. Outer Lion's Den and Hurloc Head
5. Dunphy's Pond
6. Tidewaters Area

Parks Canada
Atlantic Region

kilometers
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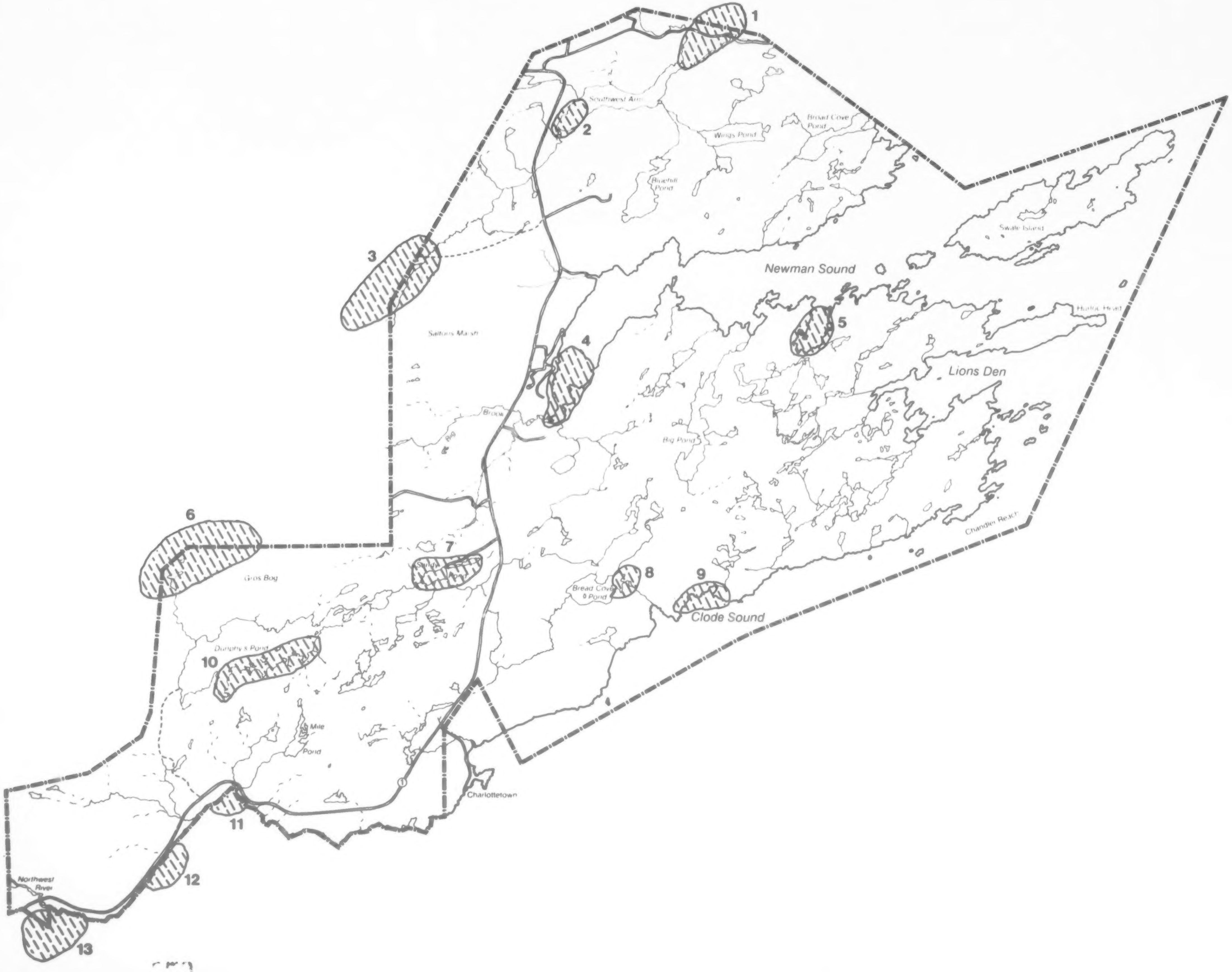
Terra Nova National Park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Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
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Newman Sound
Salton's Marsh
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Lions Den
Brook
Big Pond
Chandler Reach
6
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Gros Bog
Sandy Pond
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Bread Cove Pond
Clode Sound
10
Dunphy's Pond
Mile Pond
Charlottetown
11
12
Northwest River
13

MAP IX-5

Important Areas For Observing Dabbling Ducks And Geese In Terra Nova National Park

1. Southwest Arm - Eastport Causeway
2. Inner Southwest Arm and Southwest Brook
3. Salton's Marsh
4. Inner Newman Sound - Big Brook Tidal Flats
5. South Broad Cove
6. Western Portion of Gross Bog
7. Sandy Pond Arm
8. Bread Cove Brook - Bread Cove Pond
9. Dumpling Cove
10. Dunphy's Pond (South shore)
11. Tidewaters Area
12. Cobblers Area
13. Mouth of Northwest River

Parks Canada
Atlantic Region

kilometers
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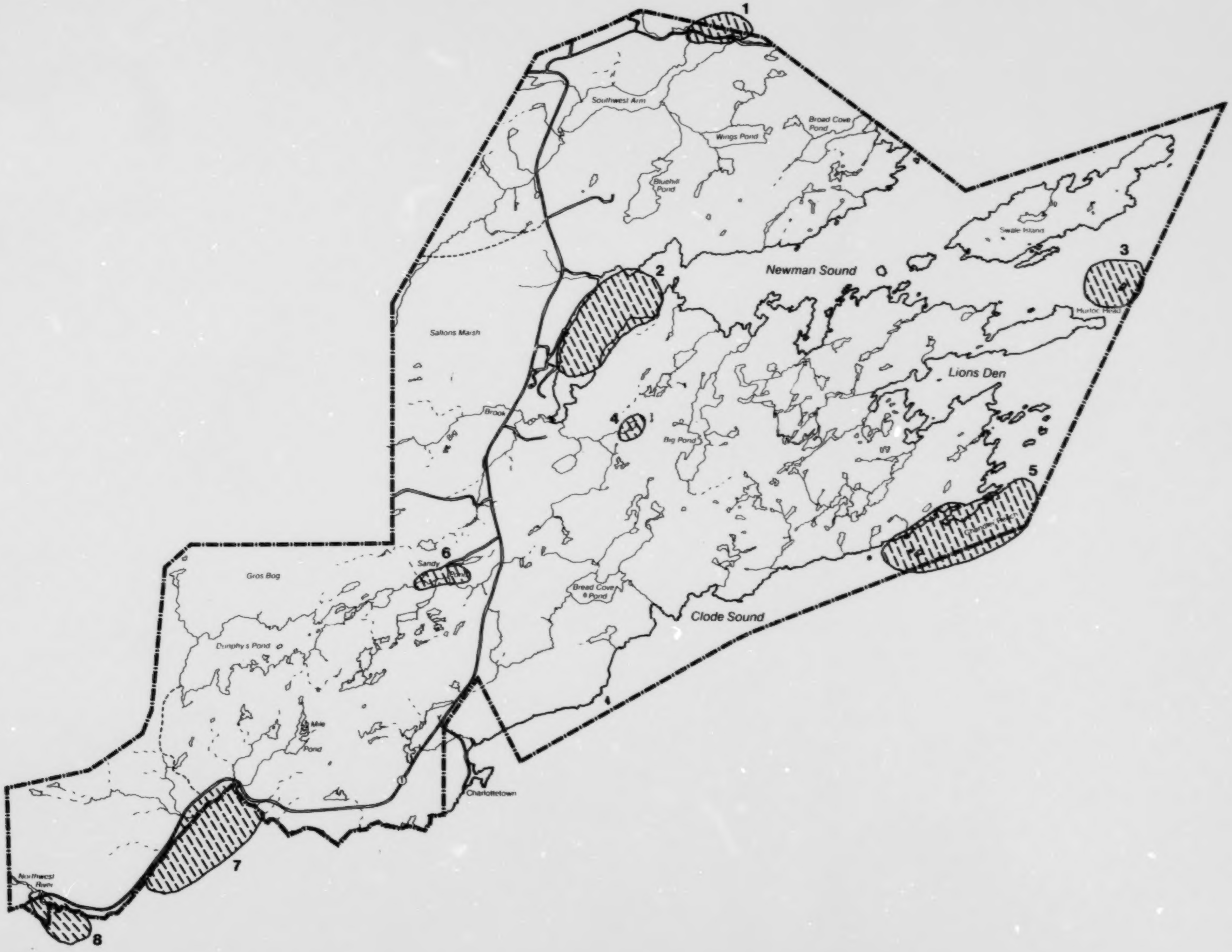
winter. Birds arrive early at breeding ponds, and nest among shrubs or in the herb layer. The female, which has sole responsibility for raising the brood, is very aggressive in defence of her nest.

Ringed-necked Duck: This species has only recently extended its breeding range across the island of Newfoundland but is well established in suitable breeding habitat in the park. Ring-necked ducks are typically birds of the small ponds with surrounding cover of sweetgale (Myrica) or leatherleaf (Chamaedaphne) and feed on floating leaf aquatic plants, pondweeds and seeds in summer. Pairs form in April and May and birds return to their natal ponds quite early in May. Larger ponds may have loose colonies, but such ponds are largely absent in the park. Most birds leave the park very early in the fall, when the diet switches to aquatic insects and molluscs. Map IX-6 indicates areas of importance for observing diving ducks.

Common Goldeneye: The American race (B. c. americana) is common year-round throughout the park with a regular wintering flock at Inner Newman Sound. Pairs return to the nesting ponds very early in the year and seek out trees with cavities or abandoned woodpecker holes. The summer diet consists of freshwater arthropods but outside the nesting season birds are found in brackish and saltwater bays, where they feed on a wide variety of animal life. Winter flocks can be quite large in shallower bays and may include both Barrow's Goldeneye (Bucephala islandica) and Bufflehead (Bucephala albeola) in their numbers, although the best habitat for both these uncommon species is outside park boundaries at Traytown.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Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
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Newman Sound
Saltons Marsh
Hurloc Head
Lions Den
Brook
4
Big Pond
5
Chandler Reach
6
Sandy Pond
Gros Bog
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
7
Northwest River
8

Terra Nova National Park

MAP IX-6

Important Areas For Observing Diving Ducks In Terra Nova National Park

1. Eastport Causeway Area
2. Inner Newman Sound
3. Waters Surrounding Copper Island
4. Puzzle Pond
5. Chandler Reach
6. Sandy Pond
7. Tidewaters
8. Mouth of Northwest River

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4
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Common Eider: This species requires protection and careful management wherever it breeds as its eggs and nest down are collected by man. Rocky coastlines with numerous inshore islands are preferred nesting sites and grassy islands with boulder cover are selected over all other sites. Eiders are able to survive extremely cold weather and nest building starts as soon as snow cover disappears in late April. The diet consists of invertebrates, especially mussels (*Mytilis*) and periwinkles (*Littorina*), and birds may also dig with their feet in muddy shorelines for small clams or worms. Large numbers of birds stage outside the park boundary, but the only records are for the Copper Island area, where nests have been found in June. That locality also produced a successful brood of Oldsquaws, which are more typically birds of the tundra biome.

Common Merganser: Although present in the park year-round, this species is most visible in April and May, when it gathers in small parties at river mouths and estuaries. Nesting pairs return to freshwater lakes, rivers and ponds in late May and generally nest in tree cavities far from the coast. Isolated pairs use fast-flowing rivers and streams, but loose colonies on islands or lake fringes often form large parties of young birds with one or two attendant females in late summer. Like all mergansers, this species feeds largely on fish, but the young consume large amounts of aquatic insects in summer. Despite their fish-catching abilities, Common Mergansers are rarely a threat to healthy salmonid populations.

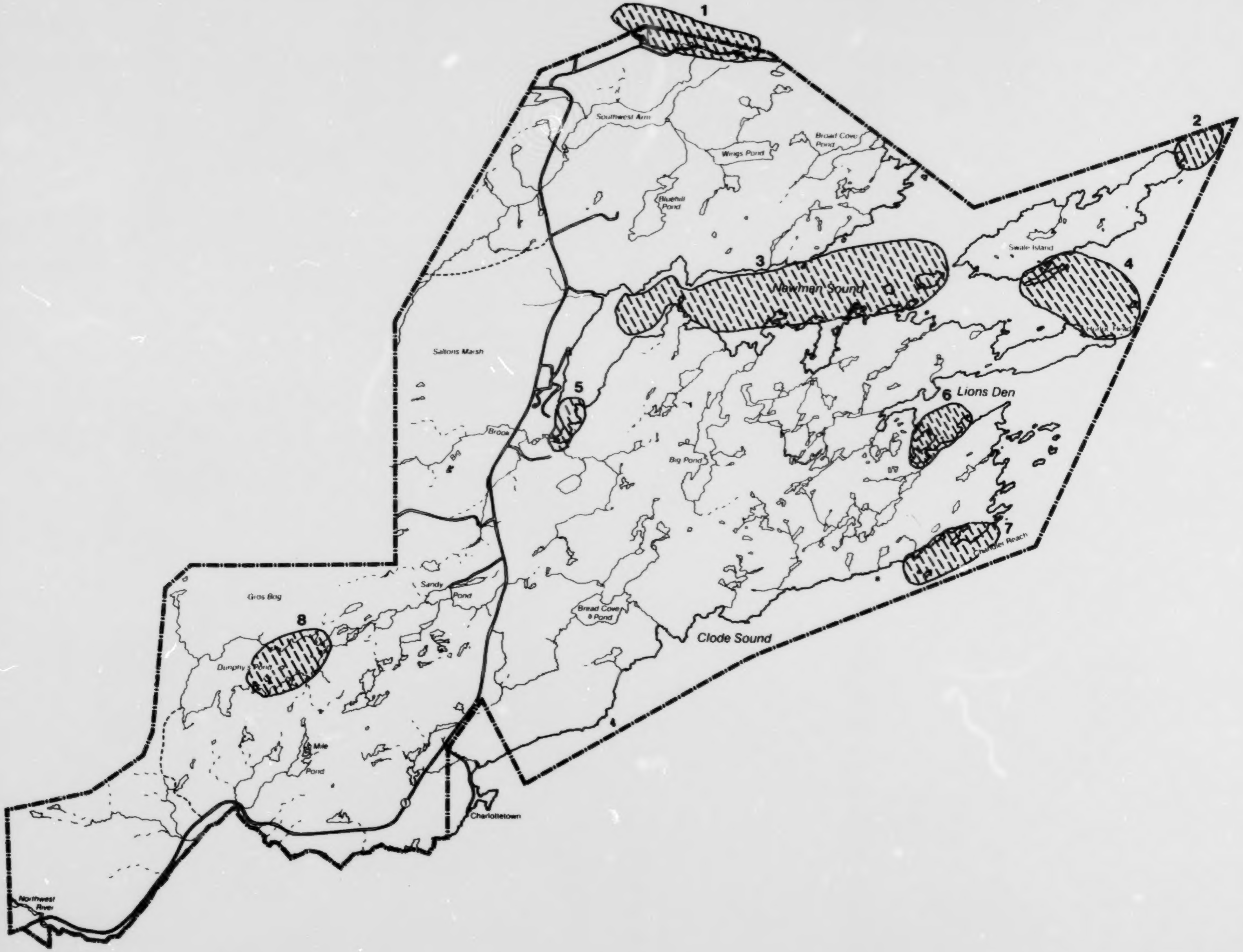
Redbreasted Merganser: This is the saltwater representative of the family and is rarely found away from the coast at any time of year. Winter flocks favour saltwater bays and indulge in communal feeding in shallow estuarine bays with little wave action. Pairs start to form early in winter and females are usually on eggs by early May. Island nesting is very popular with this species and shrubby sites are chosen for concealment of the holes and cavities selected for nests in boulder fields. Young birds eat aquatic beetles and larvae, although the major portion of the diet is fish.

Seabird Colonies and Pelagic Species of Terra Nova National Park

There are no major seabird colonies in Terra Nova National Park, although small colonies of Great Blackbacked Gull (Larus marinus), Herring Gull (Larus argentatus), Common Tern (Sterna hirundo) and Black Guillemot (Cepphus grylle) do exist along the coasts and on offshore islands. Most pelagic species rarely venture into the inner sections of Bonavista Bay but storms and fog can disorient ocean wanderers and there have been a few records of marine species in waters close to the park. There are also two Doublecrested Cormorant (Phalacrocorax auritus) colonies close to the park and birds from both colonies regularly appear on both fresh and salt water to fish during the summer months. All other species, except the adaptable gulls and terns, are essentially salt water species year-round. Map IX-7 indicates areas of observation for colonial seabirds and pelagic species.

Leach's Storm-petrel: This small species is quite regular in park waters from mid-May to July and may breed on Copper Island, although the nearest breeding colony is said to be near Salvage (Northland Associates Ltd., 1979). Birds are occasionally active during the day during stormy and foggy weather and at such times birds are very tame. Most colonies are active only at night, when the strange calls

Terra Nova National Park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Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Newman Sound
Swale Island
Hurloc Head
Saltons Marsh
Lions Den
Big Brook
Big Pond
Chandler Reach
Gros Bog
Sandy Pond
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
Northwest River

MAP IX-7

Important Areas For Observing Colonial Seabirds And Pelagic Species In Terra Nova National Park

1. Northeast Arm - Eastport Causeway
2. East Point - Swale Island
3. Newman Sound
4. Seal Island to Hurloc Head
5. Big Brook Tidal Flats
6. Inner Lion's Den
7. Chandler Reach - Minchin Island
8. East End of Dunphy's Pond

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

and bat-like silhouettes add an eerie quality to any inshore trip. Other species could occur in these waters but sightings remain hypothetical at present. Storm-blown birds are quite regular in September and October.

Northern Gannet: The largest seabird in the northern oceans has only recently appeared in park waters, but the presence of several birds in the breeding season around Copper Island and Hurloc Head suggests that birds from the Funk Island Colony may regularly wander into Bonavista Bay. It is possible that a satellite colony could be established on Copper Island in the future, although the species is very site loyal and prefers larger offshore stacks.

Doublecrested Cormorant: Although there are no nesting colonies in the park itself, regular visits are paid to park waters by birds from the Alexander Bay colony. The Pitts Pond colony had between 20 and 30 nests each year but no birds have been observed in the last two breeding seasons (Burrows, 1981). The first birds arrive back in the area in late April and are usually present at Traytown until mid-September.

Iceland Gull: This species (Larus alaucoides), and the larger Glaucous Gull (Larus hyperboreus), is a winter visitor that arrives in park waters in late October or November and stays until early spring. Numbers of both species are usually very small and vary with the severity of the winter. Ivory Gulls (Pagophila eburnea) are also possible in these waters, having been recorded at Fogo Island and Notre Dame Bay in winter.

Great Blackbacked Gull: Colonies of this species tend to be small and are often found close to other colonial seabirds, especially Common Terns. The gull colony at Copper Island contains up to 50 nests and there are smaller colonies at Park Harbour and Dunphy's Pond. There is a colony of about 75 pairs in an island in Pitts Pond, just west of the park. The species is a year-round resident, but numbers may build up to over 100 at Inner Newman Sound in early to mid-September.

Herring Gull: This species has been largely responsible for the drop in Common Puffin numbers in the western Atlantic. The largest park colony is at Copper Island, where 200 or more pairs breed, but satellite pairs are found throughout the park. Non-breeding birds are also found along the coasts and prey heavily on tern colonies. Although seen throughout the year in the park, Herring Gulls are most abundant in early fall, when over 700 have been counted in Inner Newman Sound (Burrows, 1980).

Ringbilled Gull: This species (Larus delawarensis) is a rather fickle breeding species and often deserts long-established colonies for no apparent reason, only to return a few seasons later. There are no colonies along the east coast of Newfoundland, but large wintering flocks on the Avalon Peninsula and regular visits from increasing number of birds between May and September suggest that a new colony may eventually be established somewhere along the east coast. The most likely location in the park would be one of the tern islands, although this species is very selective in its choice of nesting habitat.

Common Tern: Although a few Arctic Terns usually appear in nesting colonies, this is the typical nesting tern in the park. Most colonies are small and number between 15 and 80 pairs, with birds arriving back from the south in late May and remaining until mid-September. Colonies are located on small islands and rocky points and the majority have very little vegetation. Three of the park colonies are located on very marginal sites and the choice of habitat may reflect conflict with inshore fishermen, who tend to use better locations for storing lobster pots and other fishing material.

Black Guillemot: This is the only regularly nesting alcid in the park. Birds are present inshore year-round and nests have been located all along the outer coast. Black Guillemots are less colonial than other alcid species and require much less in the way of management as they show much less preference for the open water or long distance migrations.

Birds of Prey In Terra Nova National Park

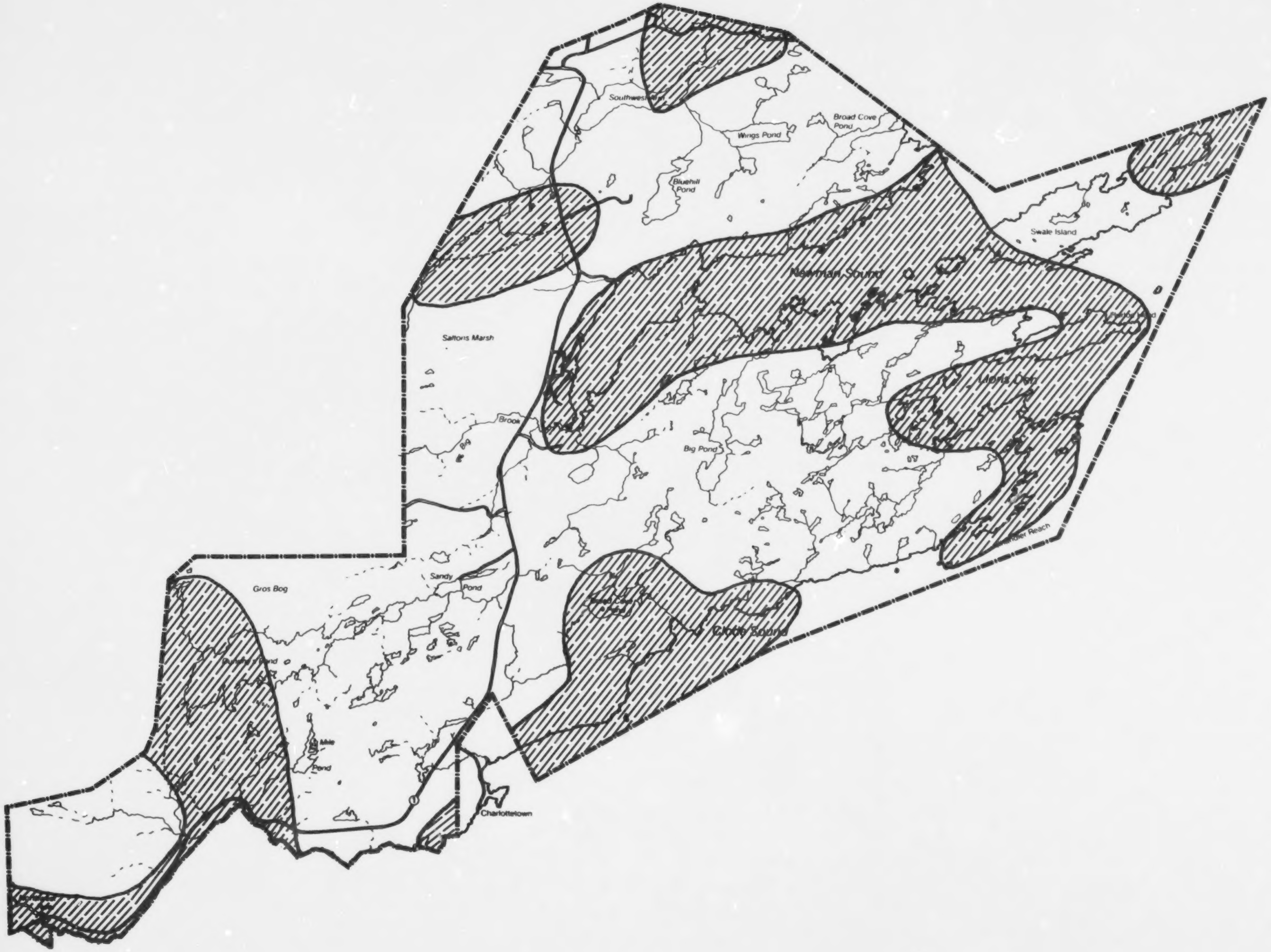
Terra Nova National Park attracts birds of prey throughout the year and several species are commoner than in other parts of eastern and central Newfoundland because of the protection offered under national park status. Since its inception in 1957, Terra Nova National Park has provided records of 9 species of diurnal birds of prey and 4 owls, with unsubstantiated sightings of three other species. All groups are well represented in the park, with accipiters widespread in wooded areas, Osprey (Pandion haliaetus) occupying freshwater and brackish ponds and bays, Bald Eagles (Haliaeetus leucocephalus) frequent sites along the coast and rocky shorelines and owls are a feature of the treed bogs and forest glades. Several species are rather rare in Atlantic Canada and breeding populations in national parks may be crucial in maintaining stable populations. At least three other species are possible for eastern

Newfoundland and may eventually be recorded for the park. The only unusual records are late migrating Gyrfalcons (Falco rusticolus). Important areas for observing birds of prey are shown in Map IX-8.

Goshawk: Although generally considered as a year-round resident of boreal forests, the Goshawk is in fact quite strongly migratory and young birds regularly make long distance migrations southwards in the fall. Goshawks pair for life but nesting pairs establish separate ranges in winter. Woodland areas with fields or wetlands are preferred and nests are usually located in treetops with clear access by stream course, firebreak, trail or natural glade. The hunting range is up to 6 km. and most prey is caught in a low level chase in flight, or on nests, branches and the ground. Prey is caught and killed with the powerful talons, which are capable of inflicting serious injury on pets and humans.

Sharpshinned Hawk: This species may breed in the park. It is best known as a migrant in May and late September, when its songbird prey is most readily available. Breeding birds prefer dense groves of conifers for nest sites, although most hunting takes place in open forest glades and edge habitat.

Roughlegged Hawk: This species breeds on higher ground and windswept barrens throughout Newfoundland and there may be a few summering birds in the park, although records are few. Small mammals, and occasionally larger prey, are taken throughout the year. Pairs are strongly territorial in summer, although several birds may roost together in winter. Open terrain is preferred and most hunting is done from low vantage points, such as trees or posts, or in a distinctive hovering and soaring hunting flight unique to the species.


Southwest
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
Newman Sound
Saltons Marsh
Brook
Big Pond
Lions Den
Chandler Reach
Gros Bog
Sandy Pond
Dunphy's Pond
Clode Sound
Mile Pond
1
Charlottetown

Terra Nova National Park

MAP IX-8

Important Areas For Observing Birds Of Prey In Terra Nova National Park

Parks Canada
Atlantic Region

kilometers
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Bald Eagle: About eight pairs nest regularly in the park along the outer coasts, making Terra Nova National Park an important breeding location for this species, which is slowly recovering from a population crash in most of its range. The major cause of the decline was chemical residues in fish prey and the resultant drop in fertility and eggshell thickness. This situation could occur again if widespread spraying of watersheds outside the park area takes place. Since the birds pair for life and return to the traditional nesting territory each year any area that supports a breeding pair should be zealously protected. The nests are usually large structures in trees or on rocky cliffs close to salt water and are added to each year until the weight of the structure collapses the supporting tree. Existing nest sites are not under any immediate pressure but encroachment of nesting territories by fishermen and back-country development could threaten some pairs close to visitor use areas.

Northern Harrier: Harriers are long winged and long tailed hawks closely associated with marshes and wetlands, although a wide range of open terrain is used outside the breeding season. Most prey is very small and consists of voles, small songbirds, frogs and insects caught by means of a distinctive hunting pattern. The species roosts communally with Shorteared Owls (Asio flammeus) in most of its range and shares its hunting grounds with this species elsewhere. A few birds may summer in the park and nests are found on the ground in bogs and fens.

Osprey: This is another fish-eating species that has suffered from chemical insecticide residues throughout its range. Unlike the Bald Eagle, which is a year-round resident, the Osprey migrates south in winter and returns in late April, when the early arriving males claim their traditional nest sites and wait for their mates. Tall trees close to fresh or brackish water are the preferred sites but this species will utilize hydro poles and other man-made structures if food is readily available in an area. Hunting technique vary but Ospreys are almost entirely dependent on fish, which are usually caught in a shallow feet-first plunge from a hover. Birds, frogs and mammals may be taken to supplement the diet, especially if a late brood is still together when the first frosts cut off the easily caught flounders in shallow estuaries. Groups of birds sometimes appear at favoured sites in late summer and fall and few birds stay in the park after the end of September. A certain amount of nest disturbance is tolerated once the young have hatched and to date the traditional nest sites have not been threatened by development. However, a return to chemical spraying could once again subject this species to high levels of toxic chemicals in its diet with dire consequences for the eight or more pairs that nest in the park.

Peregrine: This species may occur as a casual migrant from northern breeding grounds in the fall, although its normal nesting range is now remote from the park. Urbanization and chemical residues combined to reduce the eastern race to a dangerously low level and there have been a number of research programs in Canada and the United States designed to return the species to its former range. The most successful method is likely to be release of fledglings by "hacking" methods. This has worked in about 70 per cent of the releases so far and involves the gradual independence of young birds in a prospective nesting area. Promising potential nesting areas are Ochre Hill and Malady Head. The main prey taken are birds, from small warblers to geese and hawks, and migrants often follow the southbound flocks of seabirds, ducks, shorebirds and gulls in fall. The diet more closely resembles that of the equally likely to be seen Gyrfalcon.

Merlin: In Newfoundland this is the common falcon species and can be seen year-round, although most immatures leave the Island in fall. Open tracts of low, rough vegetation, including coastal strips, sand dunes, salt marshes and wetlands, are preferred on migration but nests are almost always found in young conifer stands or open groves where small songbirds and mammals are readily available. Most prey is chased down in flight and the species is capable of outdistancing and outmanouvering swallows and dragonflies. Merlins rarely build their own nests and prefer to take over abandoned hawk, owl or crow nests in tall trees, although barren ground nesting birds will sometimes scrape out a ground nest in dense vegetation. Merlins are fierce defenders of their nests and will attack larger birds and mammals, including man. Pairs are very site loyal and will return to a favoured nest site even if the nest itself is destroyed.

American Kestrel: Although a rare summer visitor at the moment, this species is extending its breeding range across Newfoundland and is likely to be the main beneficiary of land use changes associated with the proposed golf course. Open fields and farmland is chosen above other habitats and a variety of cavities and bird boxes are used for nesting purposes. Small birds and mammals are taken on migration, but the main summer diet consists of grasshoppers and other insects.

Great Horned Owl: A few pairs of this nocturnal species nest in the park and exhibit a very variable habitat preference from open country to dense coniferous forests. Nesting pairs require at least 2 sq. km. of good feeding territory and prey largely on Snowshoe Hare and Ruffed Grouse. Eggs are laid very early in the year and the young are usually fully feathered by the time park services are in full swing in June. Old hawk or crow nests are the usual nest site, but hollow trees may also be used.

Snowy Owl: Basically an arctic tundra breeder, the Snowy Owl is rarely seen away from open country where mammals are readily available. A few Ruffed Grouse and Willow Ptarmigan (Lagopus lagopus) may be taken in winter, when the species is most likely to be seen in the park, and migrants along the coast almost certainly prey on returning seabirds. A summer record at Flat Island on June 5, 1979 could have been of a late migrant or nonbreeding bird, although island nesting is not unknown in Notre Dame Bay to the north.

Hawk Owl: Occasional summer records from its favoured musket and conifer habitat suggest that this species may nest in the park, although its status throughout the year is not known. Old raptor or crow nests may be used, but the American race (S.u. caparoch) seems to have switched to natural cavities or abandoned woodpecker holes in most of its ranges. As a diurnal predator of rodents, birds and insects, the Hawk Owl is the most visible of the park's owls, although perhaps one of the rarest.

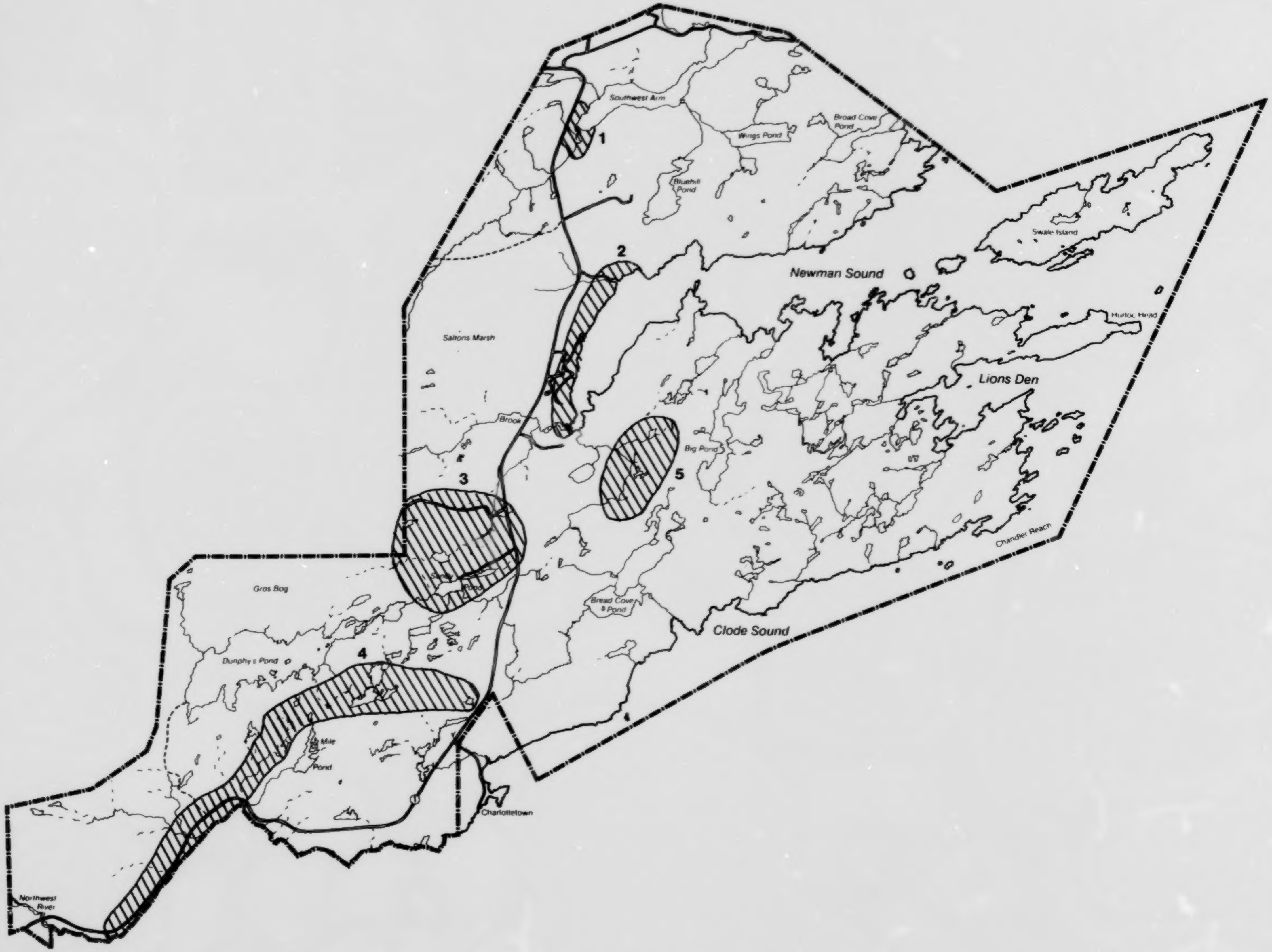
Boreal Owl: The only records of this small owl have been from the burn area of the Newman Sound Campground, although it undoubtedly nests elsewhere in the park. The preferred habitat of dense coniferous forest, especially spruce, and bog edges is common throughout the park and more visits to suitable areas at night in May and June would almost certainly turn up more nesting birds. Woodpecker holes are an ideal size for this species which only migrates any distance when heavy snows cover up vole runs, so deserted stumps and abandoned woodpecker nests should not be destroyed, even in heavy visitor use areas, where nesting birds remain largely invisible throughout the year.

Gallinaceous Birds of Terra Nova National Park

Gallinaceous birds are found throughout North America from arctic-alpine boulder fields to boreal and mixed forests. Three species are possible in the park and considerable changes have taken place in the last decade as a result of the successful introduction of the adaptable Ruffed Grouse (Bonasa umbellus). This is now the most widespread Gallinaceous species in the park, having supplanted the native Willow Ptarmigan (Lagopus lagopus) in all but the marginal bog and rock barren habitats. Spruce Grouse (Canachites canadensis) may also occur in the park area, having been introduced north of the park around Gander Lake, but there have been no confirmed sightings. The success of the Ruffed Grouse introduction can be attributed to their flexible habitat requirements, high fecundity and promiscuous nature, all of which make them more adaptable than the monogamous Willow Ptarmigan and less aggressive spruce Grouse. Map IX-9 indicates areas of observation for gallinaceous birds in Terra Nova National Park.

Ruffed Grouse: Introduced to the Island of Newfoundland in 1956 and 1966 for hunting purposes,the Ruffed Grouse has proved a prolific and adaptable breeding species. First noted on Christmas Bird Counts in 1974, it is now an abundant nesting species in Terra Nova National Park and is an important prey species in spruce, birch and mixed forests.

Terra Nova National Park



Southwest Arm
Broad Cove Pond
Wings Pond
Bluehill Pond
Swale Island
Newman Sound
Hurloc Head
Saltons Marsh
Lions Den
Brook
Big Pond
Chandler Reach
Gros Bog
Bread Cove Pond
Clode Sound
Dunphy's Pond
Sandy Pond
Mile Pond
Charlottetown
Northwest River
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MAP IX-9

Important Areas For Observing Gallinaceous Birds In Terra Nova National Park

1. Southwest Arm Area
2. Inner Newman Sound Shoreline
3. Terra Nova Road to Sandy Pond
4. Longwaters Trail Area / Tidewaters to Cobblers Shoreline
5. Bread Cove Hills Area

Parks Canada
Atlantic Region

kilometers
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The first courtship drumming takes place in late April and broods are commonly seen throughout the park in June and July. A stomach analysis of two Ruffed Grouse killed in window collisions (March, 1980) revealed the difference in diets between individuals and/or weather conditions, over a short time span. A bird killed on December 21, 1979 had 75 per cent hawkwee, 20 per cent buds, 1 per cent clover, 1 per cent fall dandelion and 1 per cent dried grass, seeds and small twigs and another bird examined on January 2, 1980 had 75 per cent large willow buds, 15 per cent trembling aspen twigs and 10 per cent birch flowers.

Willow Ptarmigan: Willow Ptarmigan are birds of the open bogs and barren hillsides and prefer shrubbery of willow or dwarf birch. Well-grown vegetation is chosen above bare ground, rocks or lichen cover, but park birds have had to adapt to less attractive areas in the face of possible competition from Ruffed Grouse.

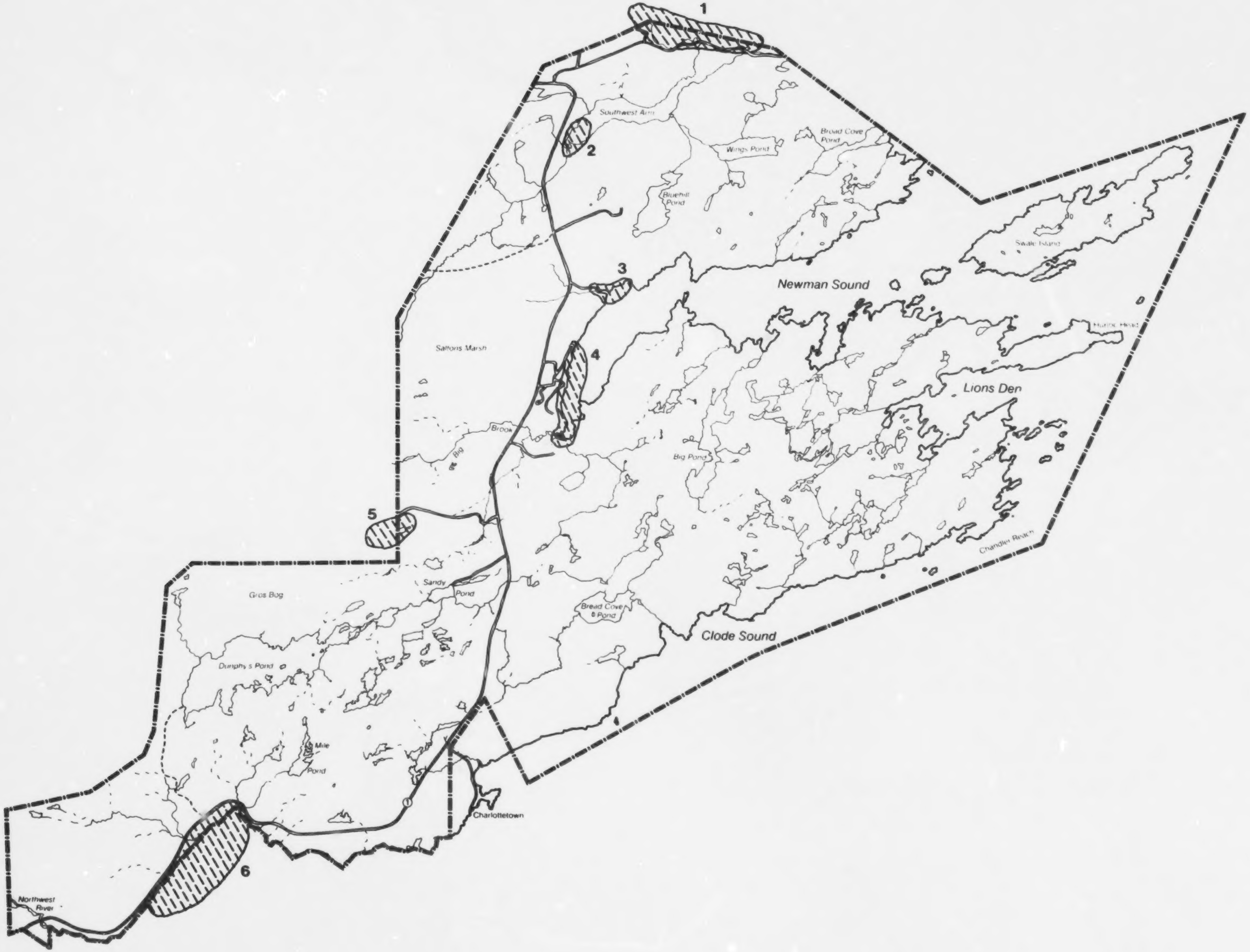
Most food is taken on the ground, but Willow Ptarmigan also feed from low hanging branches and trees. Birds will often dig through snow to reach food and can wander over considerable distances in heavy snow, while still maintaining a well defined winter territory. On the Island of Newfoundland the local race (L. l. alleni) has a diet of buds and twigs of blueberries (Vaccinium), buds and catkins of birch and alder and buds of sweetgale (Myrica) in winter, last year's berries and blueberry leaves in spring and summer and berries, buds and twigs in fall.

Shorebirds of Terra Nova National Park

While numbers in Terra Nova National Park do not compare with those on the west coast of Newfoundland and in the Maritimes, several areas are considered important enough to justify special consideration as shorebird sanctuaries. Areas of importance have three things in common.

The first is the existence of an extensive intertidal feeding zone, the nature of which influences numbers and diversity. The second is the existence of suitable roosting sites and the third is the existence of large salt marshes. These conditions rarely occur together in Newfoundland, but the Inner Newman Sound-Big Brook Flats area fulfills most of the requirements and can support numbers of shorebirds (up to several hundred) at any one time. Other beach sites of very limited importance are Burnt Point, Salton's Beach and Barachois, Tidewaters and Cobbler's Beach. These are all indicated on Map IX-10.

Most shorebirds seen in the park are most active at low tide, when large mud flats are exposed at Big Brook Flats. However, a few species, such as Semipalmated Plover (Charadrius semipalmatus), Greater Yellowlegs (Tringa melanoleuca), Spotted Sandpiper (Actitis macularia), Least (Calidris minutilla) and Whiterumped Sandpipers (Calidris fuscicollis), also feed at high tide in the berm (seaweed line) from the mouth of Big Brook to Salton's Barachois. Favoured roosting sites are located on the far shore of Inner Newman Sound for Greater Yellowlegs and Blackbellied Plover (Pluvialis squatarola), Salton's Beach and Barachois for Greater Yellowlegs and Spotted Sandpiper and the Campfire Circle Beach for Greater and Lesser Yellowlegs (Trigna flavipes), Semipalmated Plover, Least and Semipalmated Sandpipers (Calidris pusilla). Most species seem to prefer rocky or pebbly beaches on spits by shallow water, although some birds may roost on sandy beaches and marshes. Greater Yellowlegs also roost and feed at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Wings Pond
Bluehill Pond
Swale Island
Newman Sound
Saltons Marsh
Lions Den
Big Pond
Brook
Big
Chandler Reach
Sandy
Pond
Gros Bog
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile
Pond
Charlottetown
Northwest River

Terra Nova National Park

MAP IX-10

Important Areas For Observing Shorebirds in Terra Nova National Park

1. Burnt Point - Eastport Causeway
2. Inner Southwest Arm
3. Salton's Wharf Area
4. Inner Newman Sound - Big Brook Tidal Flats
5. Gull Pond - Gross Bog
6. Tidewaters - Cobblers

Parks Canada
Atlantic Region

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Tidewaters and Cobbler's Beaches with Spotted Sandpipers. Rarities are apt to appear almost anywhere in the park and to date Pectroal Sandpiper (Calidris melanotos) has been seen at Burnt Point, Solitary Sandpiper (Tringa solitaria) at Southwest Arm, Ruddy Turnstone (Arenaria interpres) at Salton's Barachois, Spotted Redshank (Tringa erythropus) at Big Brook Flats and Baird's Sandpiper (Calidris bairdii) at Cobbler's Beach. Three shorebirds species; the Spotted Sandpiper (Actitis macularia), the Common Snipe (Capella gallinago) and the Greater Yellowlegs, nest regularly in Terra Nova National Park. The American Woodcock (Philohela minor) and Least Sandpiper could conceivably breed in less accessible areas of the park. Common Snipe are birds of the open bog and build their nests on the ground, usually with some protection by a clump of sedge or heath plants. Breeding pairs maintain a courting territory in which the male performs a series of aerobatic "drumming" flights in May and early June, but several pairs can share a favoured fen or bog. The abundant Spotted Sandpiper, is found around almost every bay and lake margin in the park, as well as along most freshwater stream courses. The downy young are ready to leave the nests in grassy areas almost as soon as they hatch in early July and family parties are common along the shores of Inner Newman Sound later in the month. Greater Yellowlegs are the most selective breeding species and most pairs are found on the open and treed bogland of Gross Bog and Salton's Fen. A few birds may nest at Big Brook, where the marshes provide food and shelter, but most birds seen along Inner Newman Sound in the summer are non-breeding birds.

Semipalmated Plover: A few birds may appear in mid-May, but the major movement through the park is concentrated between mid-August and mid-October. Adults are most prominent in

August and juveniles form the majority of sightings between September and mid-October. Parties of 2-6 are regular and there is an early September record of 22 at Inner Newman Sound.

Blackbellied Plover: Although a few adults are regular in early August, most birds appear at Big Brook Flats between early September and mid-October. Adults seem to outnumber juveniles in this species, suggesting a different migration route, but later birds are almost always mixed flocks. The late date of departure so far is October 21. A single American Golden Plover (Pluvialis dominica) was noted at Salton's Beach by Stuart Tingley on September 24, 1979, but spring records could easily involve the closely related Eurasian Golden Plover (Pluvialis apricaria), which has occurred on several occasions in Newfoundland in April and early May. These species can easily be confused with Blackbellied Plovers in intermediate and winter plumage.

American Woodcock: This very specialized shorebird is rarely seen along shorelines, but still shows a preference for wet ground with a particular liking for alder swales. This habitat has turned up single birds at three localities in the park in both spring and fall and it is likely that the species may attempt breeding in the near future, although there are only a few nesting records for the Island. Earthworms are a favourite diet and are located by the fleshy tip to the long bill as it is probed into soft mud and earth.

Common Snipe: Spring birds start to appear in late April and by mid-May the twilight sounds of courting snipe are a feature of the park. Most bog and fen areas can support one or more breeding pairs of snipe, but the relative isolation of this habitat and the tendency of nesting birds to sit tight until the last second make them more likely to be heard than seen by the majority of park visitors. Ground predators destroy many nests before the precocious young hatch and it is important that dogs in the park are leashed and carefully controlled in areas where snipe are known to nest.

Greater Yellowlegs: Small numbers of this species can be seen along the shores of Inner Newman Sound from late April to late October, with a few non-breeding birds summering in the area, while breeding pairs move to the fens and bogs. Numbers build up again in late July, when 46 have been seen on Big Brook Flats, and reach a peak for juveniles in early September. Most birds are seen along Inner Newman Sound, but a few regularly visit the other beach sites throughout the park. A few Lesser Yellowlegs can be expected to appear in late July to early September and there has been a single visit from a Solitary Sandpiper on July 26, 1980.

Spotted Sandpiper: This is probably the best known of the shorebirds seen in the park and it is certainly the most widespread. Downy young are seen along shorelines in early July and many young are lost because of disturbance by beachcombers and unleashed dogs. Natural predation is a necessary hazard for any ground nesting bird, but the extra pressure on this species reached abnormal levels in mid-July to early August, when the flightless young are most vulnerable. Small flocks, composed largely of family parties, build up in late July and the last birds leave by late September.

Least Sandpiper: This smallest of the regularly occurring North American sandpipers sometimes appears in the park in mid-May, but nearly all park records are for the period from mid-July to mid-September. The species shows a preference for salt marsh fringes and feeds more at high tide than the other "peeps" seen in the park.

Whiterumped Sandpiper: A few birds may appear with the main shorebird movement in August, but the bulk of the migrating birds appear between mid-October and mid-November, when this is the only species seen in any numbers. Oozy mud flats and pebbly beaches are the preferred feeding spots of this slightly larger "peep" and birds are often noted wading to exposed rocks or crossing stream courses. As the only small sandpiper with a white rump in this region, Whiterumped Sandpipers are unlikely to be confused with any other species, although the possibility of Curlew Sandpiper (Calidris ferruginea) and Stilt Sandpiper (Micropalama himantopus) should be considered for single out-of-season birds.

Semipalmated Sandpiper: Most birds tend to arrive a little later than the main passage of Least Sandpipers and the much grayer plumage distinguishes the shoreline flocks from this closely related species. Sand and mud flats are the favoured feeding sites, but small numbers can be expected at almost any coastal site. Very few birds feed at high tide, when roosts are established on sandy and pebbly beaches. Birds with browner or rustier plumage markings should be studied closely as a single Baird's Sandpiper has been recorded at Cobbler's Beach on September 25, 1979 and Western Sandpiper (Calidris mauri) and Little Stint (Calidris minimus) are also possible on the east coast.

Woodpeckers and Holenesting Passerines of Terra Nova National Park

Two woodpecker species found in Terra Nova National Park, the Blackbacked Threetoed Woodpecker (Picoides articus) and the rarer Northern Threetoed Woodpecker (Picoides tridactylus), are high on the "most wanted" list of North American Birdwatchers. The particularly "offensive" scraggly black spruces of treed bogs and flooded forests are the favourite feeding and nesting places of these species in summer and almost any tree with barkboring beetles could be utilized in winter when woodpeckers establish loose feeding territories away from their breeding sites.

Natural cavities and old woodpecker holes are also utilized by a wide range of holenesting species, including members of families more closely associated with other habitats. Among the waterfowl, Common Goldeneye and Common Merganser are regular holenesters and both Hawk and Boreal Owls make use of cavities for nesting purposes. Another species that is likely to nest in such cavities is the American Kestrel, an open-country falcon that will clearly benefit from the construction of a golf course in Terra Nova National Park. Tree Swallow (Iridoprocne bicolor) is another widespread boreal species that has adapted to woodpecker cavities and it is also possible to find Redbreasted Nuthatch (Sitta canadensis), Boreal Chickadee (Parus hudsonicus) occupying nest sites excavated by woodpeckers, especially those of Common Flickers (Colaptes auratus) in aspens and birches. All these species tend to nest in hardwoods but feed in a variety of mixed and soft woods. Some associated species, like Brown Creeper (Certhia familiaris), are also dependent on diseased and overmature trees, and almost every passerine species found in the park area depends on a supply of invertebrates associated with diseased trees during the breeding season.

Two other species, Belted Kingfisher (Megaceryle alcyon) and Bank Swallow (Riparia riparia), are hole-nesters in riparian habitats. Both excavate long cavities in soft sandstone cliffs and banks, usually alongside water. In addition, a number of wood warblers (Parulidae) make use of natural cavities and crevices among tree roots and branches to construct partially concealed nests. Since these species are not true hole-nesters, they are dealt with in the section on passerines.

Belted Kingfisher: Although a few birds may attempt to overwinter along ice-free streams and shorelines, the majority of birds arrive in the park in mid-May and leave again in September. Gravel pits and banks are popular nest sites in the park, although sandstone banks are preferred where available. The fishing activities of this species are a source of delight to park visitors and the birds attract attention to themselves with their characteristic hovering and rattling calls.

Common Flicker: The eastern race (C. a. luteus) feeds voraciously on ants of many species and can often be seen on the ground digging up ant hills, although it also feeds on tree trunks like other woodpecker species. This is the most likely woodpecker to be seen by park visitors and can easily be recognized by the white rump and yellow shafts to the undersides of the wings and tail. Spring arrival is usually in early May and few birds remain after the main departure in mid-September.

Hairy Woodpecker: The Newfoundland race (Dendrocopus villosus) can be distinguished by the lesser amount of white on the back. Some birds may lack white in this area and others have black spots on the white outer tail feathers, a characteristic usually attributed to the smaller Downy Woodpecker. The larger size and heavier bill are usually sufficient to distinguish this species, but the preference for feeding close to the trunk and on larger limbs only is also diagnostic.

Downy Woodpecker: The eastern race (D. p. medianus) is very closely linked to the white birch, which provides its nest sites and most of the prey species it needs throughout the year. As the smallest woodpecker found in North America this species has adapted to feeding on smaller trees and outer twigs and it can also be found extracting flower seeds in later summer and fall. Some birds are also able to flycatch for food and wintering birds mix freely with chickadees, nuthatches, creepers and kinglets in loose flocks, although pairs will exclude other woodpeckers from favoured areas.

Blackbacked Threetoed Woodpecker: Of all the widespread species in the park, this northern woodpecker is the most sought-after by visiting birdwatchers. The nesting habitat of standing dead trees in burnt or flooded forests is one of the least attractive of park environments. However, non-breeding birds and sightings outside the summer season are located in many other habitats and the species is regularly seen feeding beside or flying across park roads. There is also a chance of seeing the much rarer Northern Threetoed Woodpecker in the same kinds of situations, although sightings of this species are relatively rare.

Tree Swallow: As an aerial hunter of insects this species is unsurpassed in the park. Most breeding pairs nest in old woodpecker holes in white birches by streams and ponds, although a few birds may make use of cabins and shelters if natural nest sites are not available. Early birds may appear in the park in late April, but most arrivals are in the third week of May. Some birds may linger into late September, but late swallows could be of other species, as Bank Swallows are regular in South Glovertown and both Barn Swallow (Hirundo rustica) and Cliff Swallow (Petrochelidon pyrrhonota) have been seen in the park in mid-October.

Blackcapped Chickadee: This species is widely distributed in the park where there are fairly open mixed or deciduous woods. Natural cavities in decaying stumps or old woodpecker holes are the favoured nest sites and the presence of overmature and diseased white birches seems to be a prerequisite. Some birds migrate south but wintering flocks of passerines nearly always include a few of this species in the preferred habitat and around buildings.

Boreal Chickadee: This is the boreal forest equivalent of the mixed woods Blackcapped Chickadee and its numbers are extremely high in the dominant boreal environment of the park. Most birds are year-round residents, although family parties often join together in the fall and roam through the boreal forest with other small songbirds and woodpeckers. While its close relative shows a preference for birch leafborer and casebearer, Boreal Chickadees are very partial to insect eggs and spruce budworm larvae and pupae, making them a very important component of the forest community.

Passerines In Terra Nova National Park

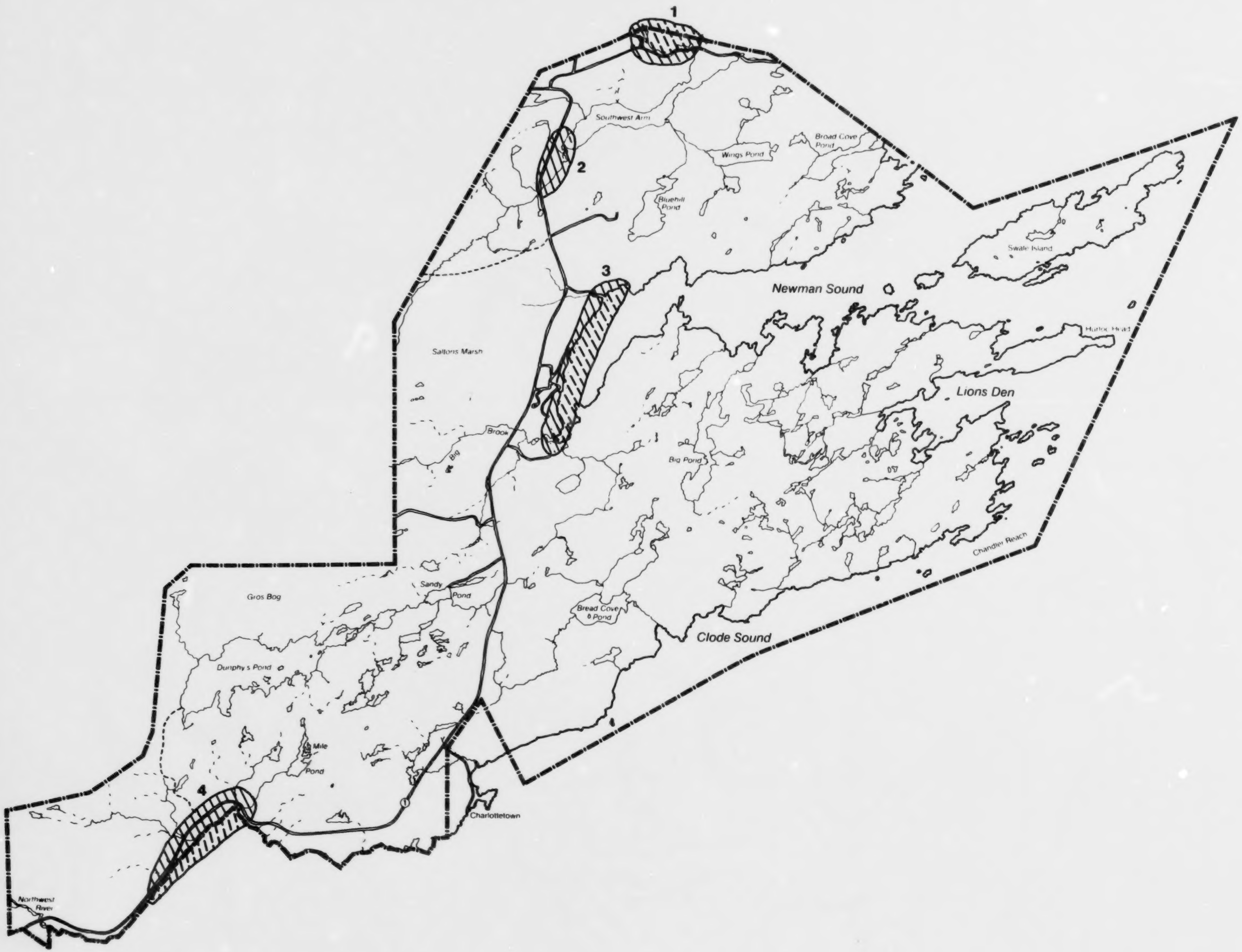
A total of 81 passerine species have been recorded in Terra Nova National Park and ten more species have been seen close enough to suggest irregular occurrence. About half this number are regular breeding species, while several others appear to be extending their breeding range to the east coast of Newfoundland. In the following text, the most abundant breeding species are indicated, together with the more unusual sightings. Map IX-11 indicates areas of observation for migrant passerines.

Flycatchers: The only common breeding species is the Yellowbellied Flycatcher, which prefers shady moss-covered coniferous forests and shrubbery on the edge of bogs and fens. However, there have been an increasing number of summer and early fall records of both Least Flycatcher (Empidonax minimum) and Alder Flycatcher (Empidonax alnorum), both of which now appear to be possible breeding species in open mixed woods and second growth. There are also a few summer records of Olivesided Flycatcher (Nuttallornis borealis) from treed bogs in the park.

Winter Wren: This species is slowly recovering from the two severe winters that decimated the breeding stock in its wintering range in the northern United States in 1975 - 1977. There have been very few sightings in the park and, for the time being at least, the species can be considered only as a rare summer and fall visitor.

Thrushes: Apart from the ubiquitous American Robin, which is found in a wide variety of habitats throughout the park, there are three other regular breeding species in the mixed and coniferous forests in the park. Hermit Thrushes

Terra Nova National Park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Broad Cove Pond
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Bluehill Pond
Swale Island
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Newman Sound
Hurloc Head
Saltons Marsh
Lions Den
Brook
Big
Big Pond
Chandler Reach
Gros Bog
Sandy
Pond
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile
Pond
4
1
Charlottetown
Northwest River

MAP IX-11

Important Areas For Observing Migrant Passerines In Terra Nova National Park

1. Burnt Point - Fox Point Area
2. Lower Southwest Brook - Inner Southwest Arm
3. West side of Inner Newman Sound
4. Tidewaters to Cobblers Day Use Area

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(Hylocichla guttata) and Swainson's Thrushes (Hylocichla ustulata) are very wide-spread from mid-May to late September, but Graycheeked Thrushes (Hylocichla minima) are much more selective in their choice of breeding habitats and are restricted to balsam fir forests with new growth.

Kinglets and Vireos: Apart from the abundant kinglets, there are records of several closely related species. Water Pipits (Anthus spinoletta) are most likely to occur in late September and early October. Cedar Waxwings appear in the park's aspen groves by mid-August. The two vireo species can be looked for any time between late May to late August in deciduous and mixed woods, with Solitary Vireos more likely than the Redeyed Vireo. The final member of this group is the Northern Shrike, which is most likely to be seen in December and January on treed bogs and open second-growth.

Wood Warblers: Of 19 species recorded in the park, 14 are fairly widespread breeding species. Several number among the most abundant breeding species in the park, including Black-and-white Warbler (Mniotilta varia), Yellowrumped Warbler (Dendropica coronata), Blackpoll Warbler (Dendroica striata), Ovenbird, Northern Waterthrush and Wilson's Warbler (Wilsonia pusilla). Of the five rarer species, Bluewinged Warbler (Vermivora pinus) and Blackthroated Blue Warbler (Dendroica caerulescens) are probably best described as vagrants, but Northern Parula (Parula americana), Cape May Warbler (Dendroica tigrina) and Black-burnian Warbler (Dendroica fusca) are already established on the west coast of Newfoundland and could be extending their range northeastward to include central and eastern Newfoundland. All three are found in mixed and coniferous woods of a similar type in the Maritimes and their increase is almost certainly a result of the spruce budworm phenomenon.

Icterids: The only regular nesting species is the Rusty Blackbird, but recent spring and summer sightings of Brownheaded Cowbirds (Molothrus ater) at both ends of the park suggest that this parasitic species could become a regular breeder. Host species include many of the park's commoner songbirds and enough open areas exist to attract the species to the park. All other species are better classed as vagrants, although Bobolink (Dolichonyx oryzivorus) breeds on the west coast and Dickcissels are regular on winter counts on the Avalon Peninsula. At the moment records of these and other rarer blackbirds and orioles are of stray birds in spring and fall.

Finches: Some species, such as Pine Grosbeak (Pinicola enucleator) and Pine Siskin, are included among the park's most wide-spread and abundant nesting species. However, several members of this sub-family, especially the crossbills (Loxia), are irruptive in their breeding and migratory tendencies and may be largely absent in some years, while abundant in others. Most species are more likely to be seen in winter, when conifer seeds provide the main diet, and in some winters flocks are common alongside the Trans Canada Highway. Common Redpolls are one of the most abundant species at this and may include a few Hoary Redpolls (Acanthis hornemanni) from the north. There has also been an unconfirmed sighting of a Eurasian Siskin (Carduelis spinus) among wintering flocks. Common Redpolls are also known to breed in areas of second growth at the north end of the park and have been joined in recent years by a few territorial Rosebreasted Grosbeaks (Pheucticus ludovicianus), although this species is more likely to be seen along Inner Newman Sound on fall migration in September and October.

Sparrows: Of 12 species recorded in the park, five are common breeding species. Of these, Whitethroated Sparrow (Zonotrichia albicollis), Fox Sparrow (Passerella iliaca) and Lincoln's Sparrow (Melospiza lincolnii) number among the park's most abundant songbirds. All three prefer second growth for feeding and breeding purposes, but rarely compete for territories as they prefer open mixed woods, alder thickets and treed barrens, and treed bogs.

Of the rarer species seen in the park, the most interesting was a mid-November Grasshopper Sparrow (Ammodramus savannarum) seen and photographed below the cabins at Inner Newman Sound in 1980. Apart from a few overwintering Darkeyed Juncos and Whitethroated sparrows, the only species to be seen in winter is the Snow Bunting, which forages in flocks of 15 - 100 throughout the park along coasts and around gravel pits and rock barrens.

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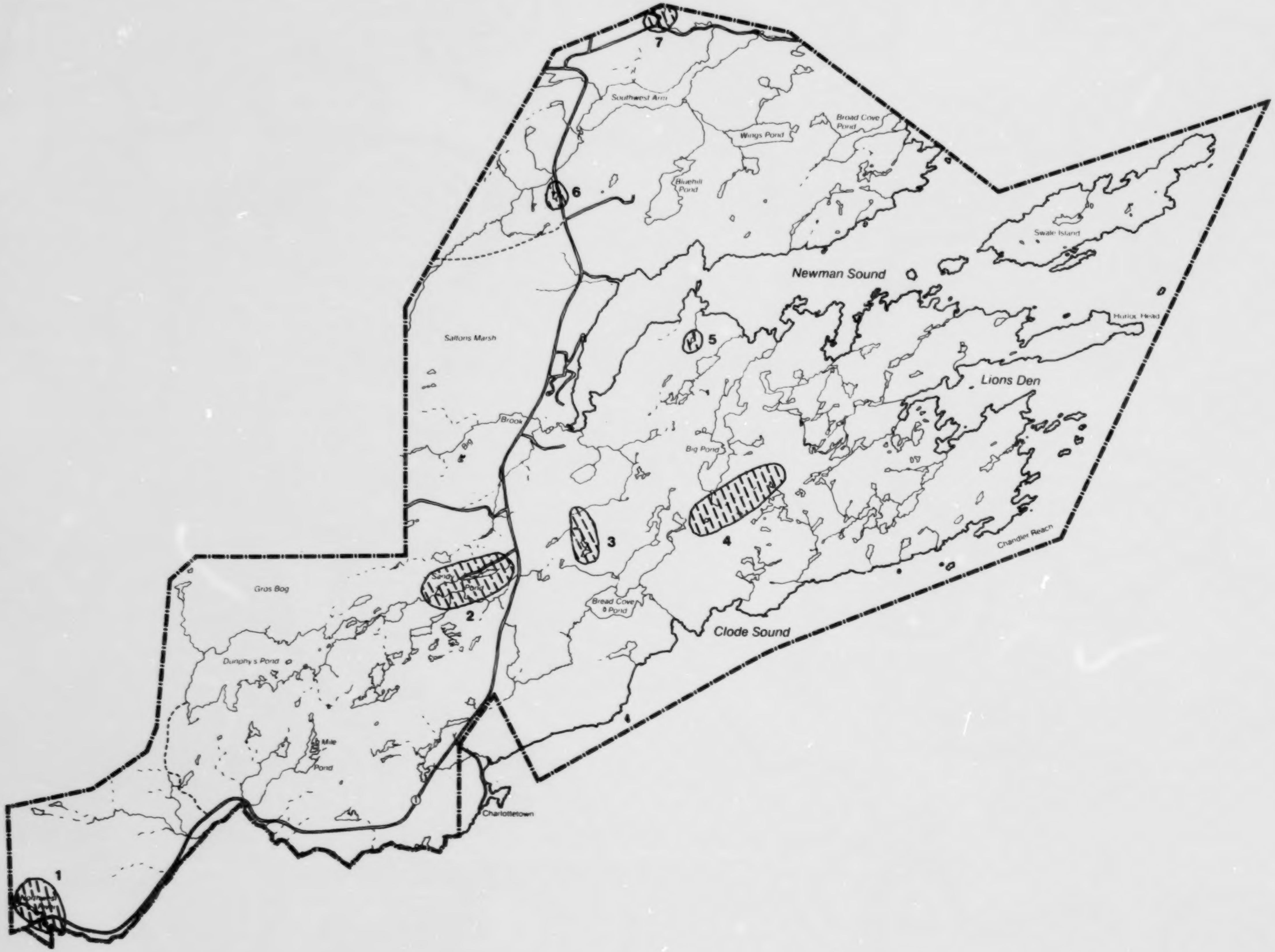
Section X

AMPHIBIANS

Terra Nova National Park has no native reptiles or amphibians. One non-native amphibian, the Green Frog (Rana clamitans), has been observed in seven areas of the park as shown in Map X-1. The frogs were introduced to the Province's Avalon Peninsula around the mid 1860's. The exact date and locality of introduction, unfortunately, is not on record (Cameron and Tomlinson, 1961).

Only a minimal amount of research on the Green Frog has been undertaken within the Province, and there have been no studies on the status of the species within the park.

Terra Nova National Park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Southwest Arm
Broad Cove Pond
Wings Pond
Bluehill Pond
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Swale Island
Newman Sound
Saltons Marsh
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Mutton Head
Lions Den
Brook
Big Pond
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Chandler Reach
Gros Bog
Sandy Pond
2
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
1

MAP X-1

Known Green Frog
Locations In Terra Nova
National Park

1. Northwest River area
2. Sandy Pond/Grassy Pond area
3. Ochre Hill Ponds area
4. Brown Bog area
5. Mt. Stamford Pond area
6. Pine Hill Pond area
7. Burnt Point area

Parks Canada
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SECTION XI

FRESHWATER AND ANADROMOUS FISH

Terra Nova National Park waters support a small variety of fish species (Table XI-1), with only seven of the 23 species known to occur in Insular Newfoundland actually being found in the park. These include the Atlantic salmon (*Salmo salar*), Arctic char (*Salvelinus alpinus*), brook trout (*Salvelinus fontinalis*), American smelt (*Osmerus mordax*), American eel (*Anguilla rostrata*), threespine stickleback (*Gasterosteus aculeatus*), and ninespine stickleback (*Pungitius pungitius*).

In addition to the above, Pacific salmon (*Onchorhynchus gorbusha*) have been observed on two occasions at the mouth of Southwest Brook (A-2) (Airphoto Analysis, 1972) and blackspotted stickleback (*Gasterosteus wheatlandi*) have been collected near Burnt Point in Broad Cove (D-1) (Kerekes and Garside, 1969).

There are no records of fish species having been introduced to the area now known as Terra Nova National Park either prior to or since the park's establishment.

Table XI-1

Check List of The Fishes of Terra Nova National Park

Salmonidae - Salmon family

Salmo salar - Atlantic Salmon; Saumon de l'Atlantique

Salvelinus alpinus - Arctic char; Omble chevalier

Salvelinus fontinalis - Brook trout; Omble de fontaine

Onchorgyunchus gorbusha - Pacific salmon; Saumon du Pacifique

Osmeridae - Smelt family

Osmerus mordax - American Smelt; Eperlan du Nord

Gasterosteidae - Stickleback Family

Gasterosteus aculeatus - Threespine stickleback; Epinoche à trois èpines

Pungitius pungitius - Ninespine stickleback; Epinoche à neuf èpines

**Gasterosteus wheatlandi - Blackspotted stickleback; Epinoche tachetèe

Anguillidae - Freshwater eel family

Anguilla rostrata - American eel; Anguille rosta

** not confirmed for park waters.

Fish Species of Terra Nova National Park

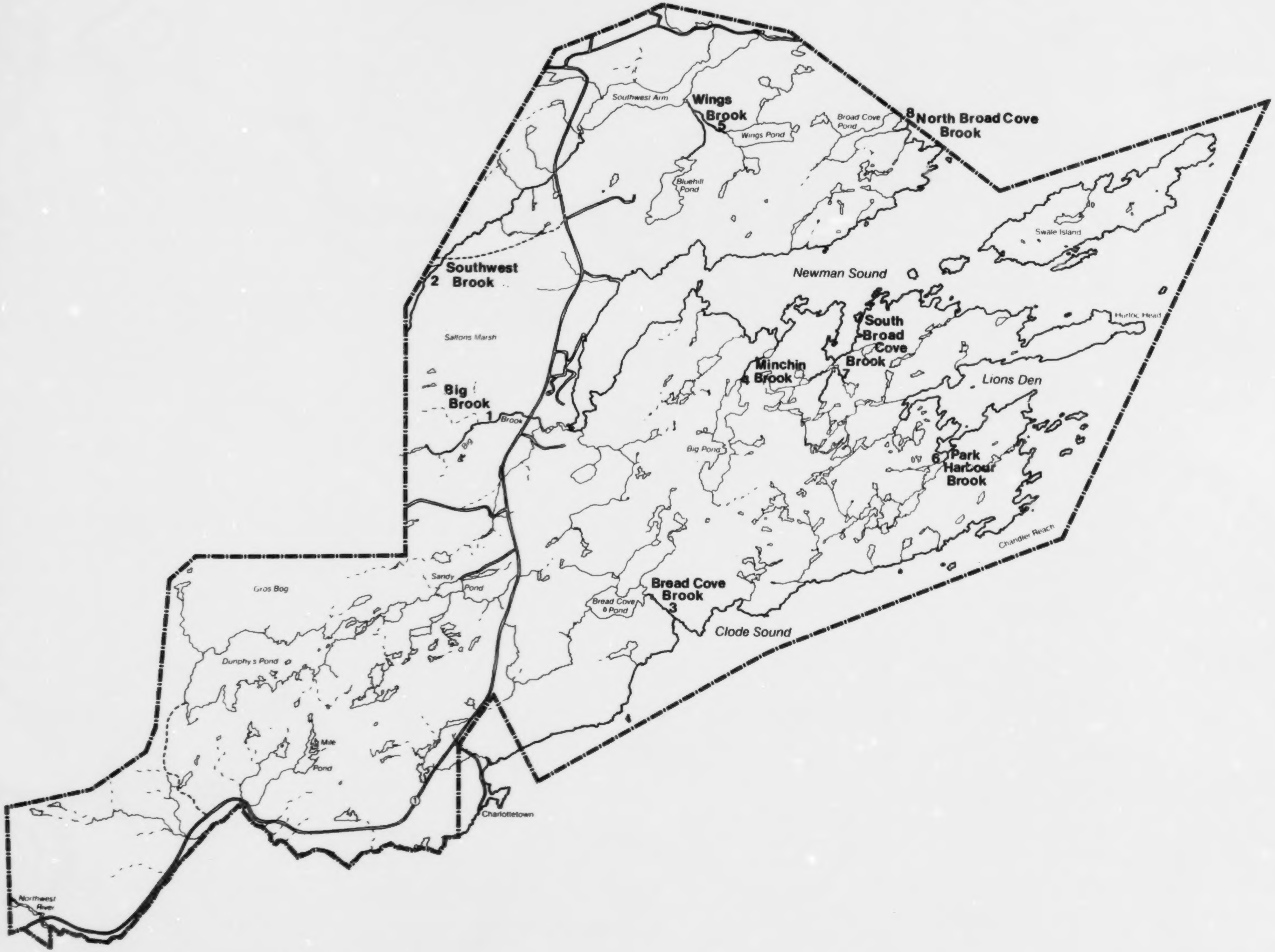
Atlantic salmon (*Salmo salar*): Both anadromous and landlocked forms of Atlantic salmon occur within Terra Nova National Park (Kerekes, 1968). The anadromous form is considered important but not abundant since none of the streams in the park are sufficiently large to support significant populations (Kerekes, 1968). Today, the adult salmon run within the park is minimal although there has not been enough study done to draw an accurate conclusion. The low salmon numbers are probably largely due to commercial fishing pressure in nearby waters.

A survey of eight major streams in 1979 (Map XI-1) by Hunter and Associates revealed that salmon were absent in only two of them while potential for salmon production was considered poor for only three streams (Table XI-2). Thompson carried out further surveys of eight streams in 1981 (Map XI-2) and found salmon to be absent from only one (Table XI-3).

Landlocked salmon (ouananiche) are fairly common in the park (Kerekes, 1968) but appear to be restricted in their distribution to deeper waters such as Bluehill (D-3) and Big Ponds (D-11) (Table XI-4).

Salmon fishing has a very limited potential in most of the park (Kerekes, 1968), although the area of Northwest River recently acquired for the golf course is considered to be one of the major scheduled salmon rivers in eastern Newfoundland.

Terra Nova National Park


Southwest Arm
Wings Brook 5
Wings Pond
Broad Cove Pond
8 North Broad Cove Brook
Bluehill Pond
Swale Island
Newman Sound
2 Southwest Brook
Saltons Marsh
Hurloc Head
South Broad Cove Brook 7
Minchin Brook 4
Lions Den
Big Brook 1
Big Brook
Big Pond
6 Park Harbour Brook
Chandler Reach
Gros Bog
Sandy Pond
Bread Cove Brook 3
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
1
Charlottetown
Northwest River

MAP XI-1

Locations Of Eight Brooks Surveyed By Hunter And Associates (1979) In Terra Nova National Park

1. Big Brook
2. Southwest Brook
3. Bread Cove Brook
4. Minchin Brook
5. Wings Brook
6. Park Harbour Brook
7. South Broad Cove Brook
8. North Broad Cove Brook

Parks Canada
Atlantic Region

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Table XI-2

Salmonid Fish Fauna And Habitat Features* Of Principal Streams In Terra Nova National Park (Hunter and Assoc., 1979)

	Salmonid Species Presence & Abundance				
Stream	Atlantic Salmon	Brook Trout	Habitat Quality For Salmonid Production	Factors Limiting Atlantic Salmon Production	Potential For Salmon Production
Big Brook	common	abundant	excellent	inadequate spawner escapement	excellent
Southwest Brook	rare	common	excellent	inadequate spawner escapement	excellent
Bread Cove Brook	abundant**	common	good/excellent	waterfalls barrier to upstream migration	good
Minchin Brook	common	abundant	good	small size	fair
Wing Brook	rare	abundant	good	inadequate spawner escapement	good
Park Harbour Brook	rare	abundant	good	poor upstream accessibility & small size	poor
South Broad Cove Brook	absent	abundant	fair/good	small size & lack of spawning sites	poor
North Broad Cove Brook	absent	abundant	fair/good	small size & poor upstream accessibility	poor

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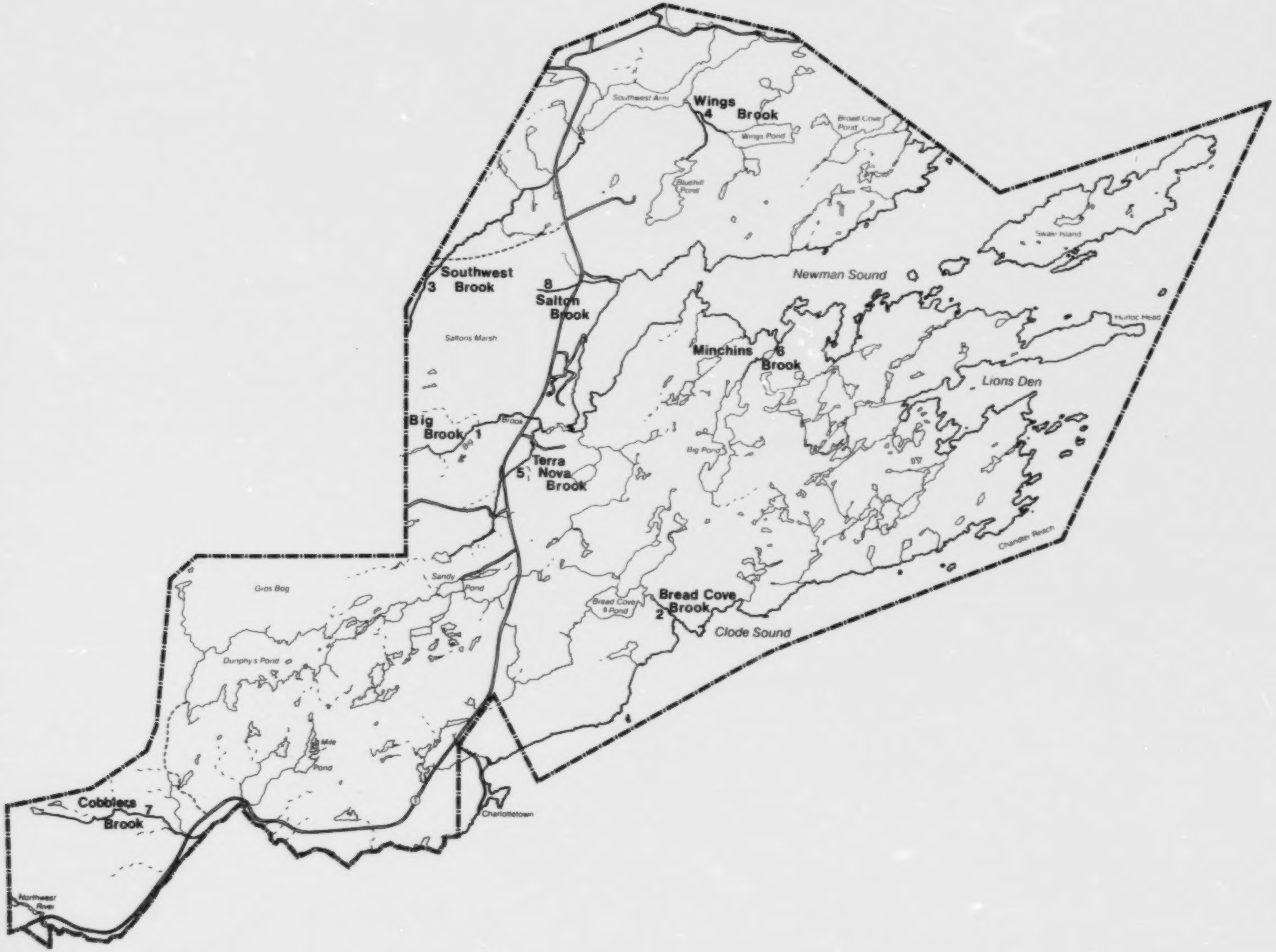
* Study considers estuarial zone and lower portion of stream only

** Below barrier falls


Southwest Arm
Wings
4 Brook
Broad Cove Pond
Wings Pond
Bluehill Pond
Southwest
3 Brook
8
Salton
Brook
Saltons Marsh
Newman Sound
Swale Island
Hurloc Head
Minchins
6
Brook
Lions Den
Big
Brook 1
Brook
Terra
5 Nova
Brook
Big Pond
Chandler Reach
Gros Bog
Sandy
Pond
Bread Cove
2 Brook
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile
Pond
Cobblers 7
Brook
Charlottetown
Northwest River

Terra Nova National Park

MAP XI-2

Locations Of Eight Brooks
Surveyed By Thompson (1981)
In Terra Nova National Park

1. Big Brook
2. Bread Cove Brook
3. Southwest Brook
4. Wings Brook
5. Terra Nova Brook
6. Minchins Brook
7. Cobblers Brook
8. Saltons Brook

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4
N

Table XI-3

Occurrence of Fish Species In Eight Major Brooks
And One Major River In
Terra Nova National Park, Newfoundland (Thompson, 1981)

Brook	Atlantic salmon	Brook trout	American eel	American smelt	Three-spine stickle-back	Nine-spine stickle-back
Big Brook	+	+	+			
Bread Cove Brook	+	+				
Southwest Brook	+	+		+	+	+
Wings Brook	+	+	+		+	
Terra Nova Brook	+	+*	+		+	
Minchins Brook	+	+*	+			
Cobblers Brook	+	+				
Saltons Brook		+*				
Northwest River	+	+*				

* indicates sea-run brook trout (sea trout) were also present

Table XI-4
Occurrence of Fish Species By Water Body
Terra Nova National Park (Kerekes, 1968)

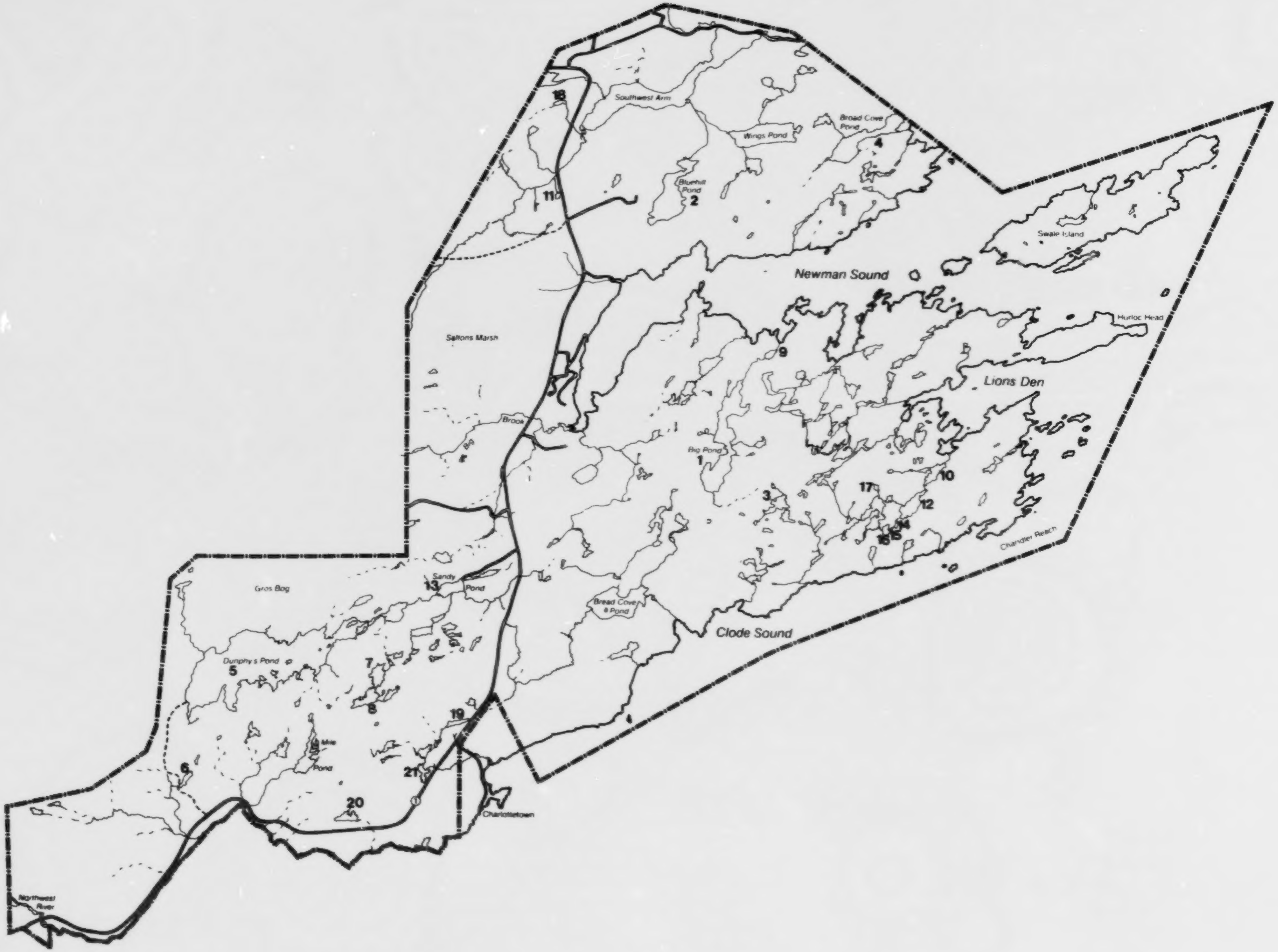
Water Body/ Pond No.	Name	Land Systems	Ouananiche	Arctic Char	Brook Trout	American Smelt	American Eel	Threespine Stickleback
1.	Big Pond	D-11	+		+		+	
2.	Bluehill	D-3	+	+	+		+	
3.	Bog Ponds (North)	D-16			+			
4.	Broad Cove Pond	D-3,D-5			+		+	
5.	Dunphy's Pond	A-15,A-17,B-1			+	+	+	+
6.	Juicey's Pond South	A-17			+		+	
7.	Long Waters Pond (North)	B-2			+			
8.	Long Waters Pond (South)	B-2,C-3			+			
9.	Minchin Pond	D-11	+	+	+		+	+
10.	Park Harbour Pond	D-20			+*			
11.	Pine Hill Pond	A-4			+			
12.	Rattle Pond	D-20			+*			
13.	Sandy Pond	B-1			+			+
14.	Shallow Ponds #1	D-20	+		+*			
15.	Shallow Ponds #2	D-20			+*			
16.	Shallow Ponds #3	D-20	+		+*			
17.	Spruce Pond	D-20	+		+*			
18.	Square Pond	A-1			+		+	
19.	Trout Pond	C-3			+			
20.	White Point Pond	A-21,B-6	no fish species found					
21.	Yudle Pond	B-6			+		+	

* Indicates sea-run brook trout (sea trout) were also present.

Arctic char (Salvelinus alpinus): Landlocked Arctic char are found in Bluehill (D-3) and Minchin Ponds (D-11), but the status of this species in the remainder of the park is uncertain.

Brook trout (Salvelinus fontinalis): Brook trout is the principal game fish in Terra Nova National Park and it occurs in virtually all ponds and streams (Kerekes, 1968). White Point Pond (A-21) (Map XI-3) is the only pond of significant size within the park which is known not to have brook trout (Table XI-4).

Sea-run brook trout are found in all major streams and lakes with good access to the sea (Kerekes, 1968). However, in 1981 Thompson found them to be abundant only in Terra Nova Brook (A-12). This brook probably represents in large measure the production centre for the entire Big Brook watershed (Thompson, 1981).


Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
Newman Sound
Hurloc Head
Saltons Marsh
Lions Den
Brook
Big Pond
Chandler Reach
Gros Bog
Sandy Pond
Broad Cove Pond
Clode Sound
Dunphy's Pond
Mile Pond
Charlottetown
Northwest River
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21

Terra Nova National Park

MAP XI-3

Twenty-One Ponds Surveyed
By Kerekes (1968)

	Water Body Name	Ecosection
1.	Big Pond	D-11
2.	Bluehill Pond	D-3
3.	Bog Ponds (North)	D-16
4.	Broad Cove Pond	D-3, D-5
5.	Dunphy's Pond	A-15, A-17, B-1
6.	Juicey's Pond South	A-17
7.	Long Waters Pond (#1)	B-2
8.	Long Waters Pond (#2)	B-2, C-3
9.	Minchin Pond	D-11
10.	Park Harbour Pond	D-20
11.	Pine Hill Pond	A-4
12.	Rattle Pond	D-20
13.	Sandy Pond	B-1
14.	Shallow Pond #1	D-20
15.	Shallow Pond #2	D-20
16.	Shallow Pond #3	D-20
17.	Spruce Pond	D-20
18.	Square Pond	A-1
19.	Trout Pond	C-3
20.	White Point Pond	A-21, B-6
21.	Yudle Pond	B-6

Parks Canada
Atlantic Region

kilometers 1 0 1 2 3 4

N

American smelt (Osmerus mordax): Landlocked American smelt is known to occur in only one pond (Table XI-4) in Terra Nova National Park, that being Dunphy's Pond (B-1) (Kerekes, 1968). A steep waterfall in Bread Cove Brook, downstream from the pond, poses an effective barrier for the upstream movements of the smelt from the sea. Thus the smelt population is physically landlocked in Dunphy's Pond. It is possible that smelt occur in other lakes as well (Kerekes, 1968).

Smelt are known to congregate during the winter off Big Brook tidal flats and in Southwest Arm (Garside & Kerekes, 1969) but they have only been documented in Southwest Brook (Thompson, 1981).

Stickleback (Gasterosteidae): Three species of stickleback are known to occur in the area of Terra Nova National Park (Table XI-1) although only the threespine stickleback (Gasterosteus aculeatus) is considered common. This species occurs in marine, brackish, and fresh waters in the park (Kerekes, 1968). Strictly freshwater populations are known to exist in Dunphy's (B-1) and Sandy Ponds (B-1).

Ninespine stickleback (Pungitius pungitius) were observed in Southwest Brook (A-2) by Thompson in 1981 while blackspotted stickleback (Gasterosteus wheatlandi) were collected by a seine in Northeast Arm (Garside & Kerekes, 1969). There are no other records for these species within the park.

American eel (Anguilla rostrata): The American eel is common throughout many of the brooks and ponds in Terra Nova National Park. It is likely that it is present in all waters connected to the sea but may not be abundant in some lakes (Kerekes, 1968).

Fish Parasites In Terra Nova National Park

Parasitic infection of fish populations is extensive within Terra Nova National Park (Kerekes, 1968). It appears that infection is heavier in ponds which are not fished. Perhaps in the heavily fished lakes the old and more heavily infected fish are removed by anglers, thus the life cycle of many parasites cannot be completed. Consequently, the incidence of parasite infection is reduced greatly in a faster-growing exploited population. A list of parasites found in brook trout is given in Table XI-5.

The nematode Philonema agubernaculum, which is apparently restricted to deep ponds only, was found in Bluehill Pond (D-3). Brook trout and Arctic char in this pond were heavily infected while ouananiche was completely free from the parasite. The incidence and intensity of infection was more prevalent in the larger (older) fish in Bluehill Pond with virtually all the larger brook trout and Artic char being infected.

The "black spot disease" in brook trout is very common in the park. Caused by the trematode Apophallus brevis, the incidence of this disease varies considerably in different ponds. In Trout Pond (C-3) for example, one finds very few infected fish while in Juicey's Pond South (A-17) virtually all trout are heavily infected (Kerekes, 1968).

The status of other fish parasites with the park is uncertain.

Table XI-5

List of Parasites Found In Brook Trout (Salvelinus fontinalis) In Terra Nova National Park

Species	Bluehill Pond	Juiceys Pond South
Trematoda		
Apophallus brevis	+	+
Crepidostimum farionis	-	+
Diplostomulum sp.	+	-
Discocotyle sagittata (=D. salmonis)	-	+
Phyllodistomum limnosa	+	-
Tetracotyle sp.	+	-
Acantocephala		
Echinorhynchus lateralis	+	+
Nematoda		
Metabronema salvelini	+	+
Philonema agubernaculum	+	-
Copepoda		
Salmincola edwardsi	+	+
Cestoda		
Eubothrium salvelini	+	+

Fish Habitat of Terra Nova National Park

Extensive fish habitat surveys have never been completed for Terra Nova National Park although some information is available for salmonid species. Within the park, salmon habitats remain in quite a natural state, capable of supporting the same numbers of salmon which they did in the past (Hunter, et al, 1979). Big and Southwest Brooks in particular have excellent habitat quality for salmonid production (Table XI-2) (Hunter, et al, 1979) while Wings Brook is also considered good (Dr. J. Gibson, pers. comm., 1982). Northwest River also has excellent habitat, although only a small section of this river runs through Terra Nova National Park. All other brooks within the park have habitat which is fair to good (Table XI-2) (Hunter, et al, 1979 and Thompson, 1981).

In general, populations of juvenile salmon in the park's streams are in a very depleted state, due to insufficient spawner escapement (Table XI-2) (Hunter, et al, 1979). Atlantic salmon (Salmo salar) were considered common or abundant in only three brooks (Table XI-2), while brook trout (Salvelinus fontinalis) were common to abundant in all areas surveyed (Hunter, et al, 1979 and Thompson, 1981). Sea-run brook trout (sea trout) were abundant only in Terra Nova Brook (A-12) (Thompson 1981).

Pond production within the park is quite adequate (Dr. J. Gibson, pers. comm., 1982) although further work is required to accurately assess actual production.

Barriers to Fish Passage in Terra Nova National Park

There are very few natural barriers to fish passage within the park although some waterfalls, such as the one on Bread Cove, partially prevent the upstream migration of fish (Hunter, et al, 1979 and Thompson, 1981). Low water levels and high water temperatures are also considered natural barriers as fish movement is restricted during periods when these conditions prevail (Thompson, 1981 and Gibson, pers. comm., 1982).

Man-made barriers such as causeways are restricted primarily to areas adjacent to the park (Hunter, et al, 1979), although a large number of stream-highway culverts along the Trans Canada Highway within the park impose restrictions by their construction, in hampering and/or blocking upstream migration of fish (Thompson, 1981).

Commercial netting outside Terra Nova National Park and illegal netting both within and outside the park is considered a major barrier to fish passage (Hunter, et al, 1979 and Thompson, 1981), and is probably largely responsible for low salmon numbers in park streams.

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Section XII

TERRESTRIAL AND NON-MARINE INVERTEBRATES

Invertebrates are the least known component of the fauna of Terra Nova National Park. An insect inventory was carried out in 1980 to provide data for this Resource Description and Evaluation, but was never completed. Information on the status of important forest insects, such as the spruce budworm, has been included in this section, although it is in part descriptive of damage to flora.

Spruce Budworm (Choristoneura fumiferana)

The recent major spruce budworm infestation in Newfoundland, which began in 1971, has been an important factor affecting Terra Nova National Park. Within the park, the spruce budworm was first recorded in outbreak numbers in 1976. Population levels remained high and caused severe defoliation for several years. The budworm peaked, however, and in 1981, the population dropped noticeably. Severe damage to fir-spruce stands in the form of top kill and tree mortality has been widespread throughout the park, particularly in areas where the fir stands are almost pure. Such areas include Platter's Beach (C-3), Blue Hill (A-5), and White Point (A-21). Black spruce has also been affected by the budworm, but damage to this tree species has been much less serious and infected trees are much more likely to survive. Table XII-1 provides the result of a spruce budworm egg-mass sampling conducted in 1978 by The Canadian Forestry Service.

Table XII-1

Results Of Spruce Budworm Egg-Mass Sampling In Terra Nova National Park In 1978 By The Canadian Forestry Service

Location	Egg-mass category*	Defoliation forecast for 1979 **
Bread Cove Brook	-	-
Platters Cove	-	-
Bread Cove	H	S
Double Pond	H	S
Jacks Pond	-	-
Ochre Hill Ponds	M	M
Terra Nova Brook	L	L
Rocky Pond	H	S
Big Pond	-	-
Half Mile Pond	M	M
Spruce Pond	L	L
Shag Point	M	M
South Broad Cove	L	L
Minchin Cove	H	S
Cannings Cove	L	L
Park Headquarters	H	S
Saltons Brook	H	S
Southwest Arm	L	L
Bluehill Pond	H	S
Long Pond North	L	L
Swale Island	-	-
North Broad Cove	M	M
Green Hill Ponds	-	-
Broad Cove	H	S
Northwest Arm	L	L
Northwest River	L	L
Cobblers Brook	L	L
White Point Pond	H	S
Yudle Pond	H	S
Moon Pond	M	M
Dunphy's Pond	-	-
Terra Nova Road	L	L
Southwest Brook	M	M

*L = Low
M = Medium
H = High

**L = Light
M = Moderate
S = Severe

Hemlock Looper (*Lambdina fiscellaria*)

In the late 1960's and early 1970's the hemlock looper ravaged fir stands between the Trans-Canada Highway and Clode Sound west of Charlottetown (C-1, 2, 3, B-5, and D-17). A balsam fir stand to the west of the park boundary near Garlands Pond (A-1) was also affected.

Balsam Wooly Aphid (*Adelges piceae*)

Balsam wooly aphid attacks have been severe near Cobbler's Brook (A-17). Balsam fir trees were cut and burned over a large area by park personnel (Airphoto Analysis Associates, 1972).

Aquatic Invertebrates

An extensive study of the park's aquatic invertebrates was conducted by Glyn Sharpe of Dalhousie University in 1967. The nineteen ponds sampled in this survey are listed as follows:

1. Bread Cove Pond
2. Bog Pond North
3. Big Pond
4. Blue Hill Pond
5. Chatman's Pond East
6. Davey Ann's Pond
7. Juicey's Pond South
8. Little Trout Pond
9. Minchin Cove Pond
10. Ochre Hill Pond
11. Pine Hill Pond
12. Southwest Brook
13. South Broad Cove Pond
14. Sandy Cove Pond
15. Square Pond
16. Trout Pond
17. Yudle Cove Pond
18. White Point Pond
19. No Name

The location of each of these ponds is shown on Map XII-1. Table XII-2 provides for each pond the surface area in acres, the maximum depth in meters, the presence of thermocline and PH.

A preliminary list of aquatic invertebrates found in Terra Nova National Park during the 1967 survey is given in Table XII-3.

Northwest River Golf Course Area Insect Inventory

A cursory investigation of the insect fauna of the Northwest River area was carried out by Dr. D. Larson of Memorial University of Newfoundland and his students of a biology class in October, 1978. Various sampling methods were employed:

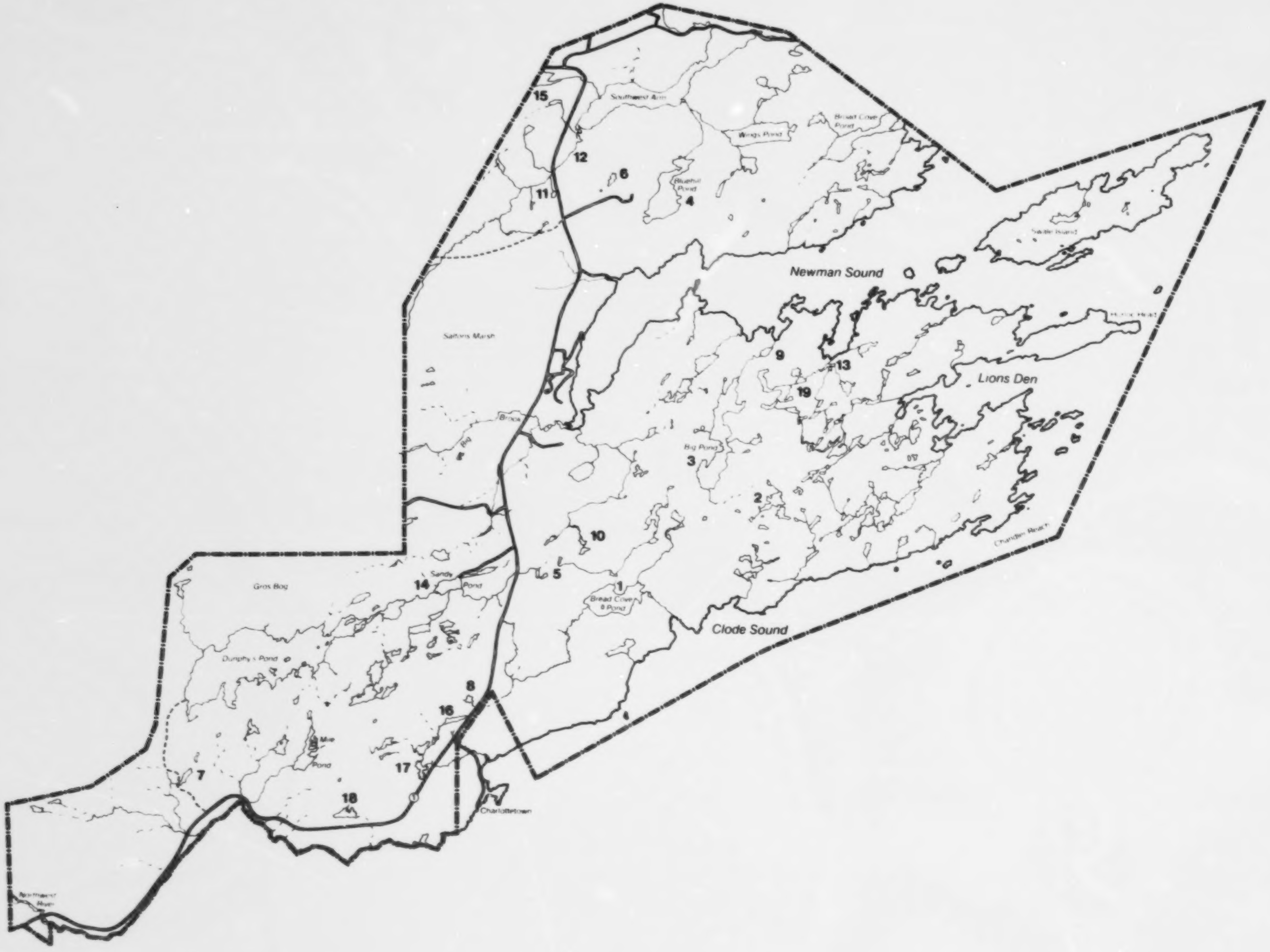
a. Surber samples - 0.09 m^2 samples from rubble riffles in the Northwest River. High water levels and swift currents prevented samples from being taken within the main channel. All samples were taken from sites above minimum low water level.

b. Timed shoreline samples - Each sample consisted of a sweepnet collection made by one person in one minute along the shoreline.

c. 0.21 m^2 soil samples - Taken from litter and humus in an open black spruce - Kalmia stand in Ecosite 15.

d. Samples of birch and alder casebearer larvae were taken by clipping midcrown branches of birch and alder respectively.

Terra Nova National Park


Southwest Arm
Weigs Pond
Broad Cove Pond
Bluehill Pond
Swale Island
Newman Sound
Salmon Marsh
Lions Den
Brook
Big Pond
Chandler Reach
Bread Cove 8 Pond
Clode Sound
Gros Bog
Sandy Pond
Dunphy's Pond
Mile Pond
Charlottetown
Northwest River
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MAP XII-1

Locations Of Twenty Ponds
Included In The Aquatic
Invertebrate Study (Sharpe 1967)

1. Bread Cove Pond
2. Bog Pond North
3. Big Pond
4. Blue Hill Pond
5. Chatman's Pond East
6. Davey Ann's Pond
7. Juicey's Pond South
8. Little Trout Pond
9. Minchin Cove Pond
10. Ochre Hill Pond
11. Pine Hill Pond
12. Southwest Brook
13. South Broad Cove Pond
14. Sandy Cove Pond
15. Square Pond
16. Trout Pond
17. Yudle Cove Pond
18. White Point Pond
19. No Name

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

Table XII-2

Surface Area, Maximum Depth, Thermocline Presence, and PH of Ponds Sampled in Aquatic Invertebrates Survey of 1967.

Pond No.	Surface Area (Acres)	Max. Depth m.	Thermocline Present	pH
1.	242	9.5	No	6.7
2.	-	7.2	-	6.5
3.	422	15.5	Yes	6.9
4.	305	20	Yes	7.0
5.	-	-	-	6.3
6.	-	4	-	6.4
7.	-	4	-	6.7
8.	-	-	-	-
9.	15	12.8	Yes	7.0
10.	-	-	-	6.5
11.	6	5.3	-	6.8
12.	-	-	-	-
13.	-	-	-	6.5
14.	70	1.2	No	6.6
15.	72	6.4	No	
16.	20	1.5	No	6.6
17.	23	10.5	Yes	6.8
18.	45	2.1	No	6.9
19.	-	-	-	6.9

Table XII-3

List of Aquatic Invertebrates of Terra Nova National Park, Newfoundland
(Preliminary List, Summer 1967)

SPECIES	POND																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CRUSTACEA. CLADOCERA																			
Bosmina coregoni				x													x		
Bosmina longirostris			x	x										x			x		
Daphnia catawaba	x	x				x	x			x	x				x	x	x		
Daphnia galeata				x															
Daphnia longiremi	x	x	x					x								x			
Daphnia pulex		x	x			x		x	x	x	x			x	x	x	x		
Daphnia schodleri						x										x			
Diaphanosoma brachyuran	x	x	x	x	x	x	x	x	x	x	x					x			
Eurycerus glacialic																x			
Holopedium gibberum		x	x	x			x	x	x		x					x			
Leptodora kindtii			x	x															
Polyphemus pediculus						x	x	x						x		x	x		
CRUSTACEA. COPEPODA																			
Cyclops scutifer			x						x	x	x			x			x		
Diaptomus minutis	x	x	x	x		x	x			x	x				x	x		x	
Diaptomus spatulocrenatus			x	x	x	x	x	x	x	x	x					x	x	x	x
Epischura lacustris	x	x	x	x		x	x	x	x						x		x		x
Macrocyclops fuscus										x						x			
CRUSTACEA. AMPHIPODA																			
Hyallela azteca	x	x	x	x	x	x		x		x	x			x		x	x	x	
Crangonyx richmondensis																x			

Table XII-3 (Contin.)

SPECIES	POND																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BILVALVIA. SPHAERIIDAE																				
Pisidium caserantum	x	x	x					x	x	x						x		x		
Pisidium conventus									x											
Pisidium ferrugineum		x	x					x	x	x			x			x				
Pisidium nitidium											x									
Sphaerium lacustre							x				x									
Sphaerium occidentale										x										
Sphaerium securis				x				x			x					x	x			
BILVALVIA. UNIONIDAE																				
Margaritifera margaritifera																				
GASTROPODA																				
Melisoma campanulatum	x			x		x	x				x						x			
Amnicola limosa				x	x		x			x			x			x	x			
Physa sp.	x										x	x					x			
PORIFERA																				
Spongilla fragilis														x						
Spongilla lacustris		x						x		x	x				x	x	x			x
Spongilla mackayii										x				x			x			
Tubella pennsylvanica										x										
ANNELIDA																				

A few species yet unkeyed.

Table XII-3 (Contin.)

SPECIES	POND 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
INSECTA. DIPTERA																				
Tabanus sp.										x	x						x			
Tendipes tentans				x		x			x		x			x						
Chaoboros						x					x						x			
INSECTA. ODONATA																				
Basiaeshna sp.				x				x				x								
Boyeria sp.											x				x	x				
Enallagma sp.										x							x			
Gomphus sp.																				
Ischnura sp.				x																
Pachydiplax sp.								x												
Orthemis sp.				x	x					x	x					x				
INSECTA. EPHEMEROPTERA																				
Leptophebia sp.				x				x								x	x			
Stenonema sp.				x							x				x		x			
INSECTA. TRICHOPTERA																				
Representatives of seven families found, as yet unkeyed to species.																				

e. Sweep samples were taken from Kalmia and alder but were not standardized.

Only a few habitats were sampled and because of time constraints, few samples were taken from any one habitat type.

The study concentrates on Ecosites 14 and 15 and the north shore of the Northwest River near the Rock Pile rapids. Thus the study is more intensive than extensive. In addition, miscellaneous arthropods were collected by hand, sweeping and looking under cover and in litter. A list of arthropods collected is presented in Table XII-4. Voucher specimens of most species have been deposited in the University collection.

Table XII-4

Annotated List of Arthropods Collected at the Northwest River Golf Course Site in October, 1978.

Collembola
- Sminthuridae - one unidentified species in litter.
- Enthomobryidae - several species in litter and humus.

Ephemeroptera (nymphs)
- Siphlonuridae
  - *Ameletus* sp. - in quiet water along river margin.
- Baetidae
  - *Baetis* sp. - on rocks in riffles.
- Heptageniidae
  - *Heptagenia* sp. - in rapids.
  - *Stenonema* sp. - under rocks in rapids.
- Leptophlebiidae
  - *Habrophlebia* sp. - in marginal eddies.
  - *Leptophlebia* sp. - in calm water along banks and in flooded terrestrial vegetation.
  - *Paraleptophlebia* sp. 1 - in rapids
  - *Paraleptophlebia* sp. 2 - 2 adult males captured in flight along river.

Ephemerellidae
- *Ephemerella* (*Eurylophella*) sp. - eddies and calm water along banks.
- *E.* (*Serratella*) sp. - in rapids.

Odonata
- Gomphidae
  - *Ophiogomphus* *colubrinus* Selys - nymphs in rapids, among *Fontinalis*. These nymphs are very intolerant of siltation.

Table XII-4 (Contin.)

Plecoptera
  Leuctridae
    Leuctra (s. str.) ferruginea Walker - in rapids.
Thysanoptera
  Phlaeothripidae - 1 species in leaf litter.
Hemiptera
  Corixidae
    Sigara penniensis Hung. - in eddies along river margin.
    Sigara sp. - along river margin.
  Gerridae
    Gerris remigis Say - quiet water along river banks.
  Saldidae
    Saldula sp.- willow litter near small stream (Land Type 14).
  Miridae
    Lygus sp. - sweeping shrubs.
  Tingidae
    Stephanitis rhododendri Hovath - sweeping Kalmia.
  Lygaeidae
    Peritrechus fraternus Uhler - in willow litter.
    Antillocoris minutus (Berg.) - in Kalmia litter.
    Kleidocerys resedae (Panz.) - deciduous litter.
    Eremocoris ferus (Say) - deciduous litter.
  Pentatomidae
    Elasmucha lateralis (Say) - in birch litter. Feeds on birch.
Homoptera
  Cercopidae
    Philaenus sp. - on herbaceous vegetation and in litter samples.
  Aphididae - 1 species on willow stems.

Table XII-4 (Contin.)

- Coleoptera
  - Carabidae
    - *Carabus serratus* Say - 2 specimens at light at Information Centre.
    - *Notiophilus biguttatus* (Fab.) - alder litter along road.
    - *Bembidion occultator* Notman - in willow litter along small stream (Land Type 14).
    - *Agonum muelleri* Herbst - under rocks along river bank.
    - *A. gratiosum* Mann. - leaf litter near stream (Land Type 14).
    - *Trichocellus cognatus* Gyll. - under rocks on dry sparsely vegetated soil.
    - *Metabletus americanus* Dejean - alder litter.
  - Dytiscidae
    - *Hygrotus sayi* B. B. - quiet water along river margin.
    - *Hydroporus undulatus* - quiet water along river margin.
    - *H. pulcher* LeConte - quiet water along river margin.
    - *H. elegans* Panz. - quiet water along river margin.
    - *H. scitulus* LeConte - on gravel in eddies.
    - *H. paugus* Fall - on clay or mud bottoms at water's edge.
  - Haliplidae
    - *Haliplus* sp. - in quiet eddies of river.
  - Silphidae
    - *Thanatophilus lapponicus* Gyll.
  - Leptodiridae
    - *Catops* sp. - in deciduous litter
  - Staphylinidae
    - *Stenus* sp. - in litter along small stream (Land Type 14) 10 additional unidentified species - most in litter.

Table XII-4 (Contin.)

Pselaphidae
    1 species in willow litter.
Ptilidae
    Ptenidium sp. - in deciduous litter.
Scarabaeidae
    Geotrupes stercoraria (l.) - at light near Information Centre.
Chrysomelidae
    Haltica corni Woods - on Cornus.
Curculionidae
    Brachyrhinus ovatus L. - one specimen found dead
    1 unidentified species in willow litter.
Elateridae
    2 larvae in rotting wood.
Cantharidae
    larvae in leaf litter and soil samples.
Trichoptera (larvae)
Hydropsychidae
    Hydropsyche sp. - nets built among rocks in rapids.
Lepidostomatidae
    Lepidostoma sp. - in riffles.
Leptoceridae
    Oecetis sp. - in riffles.
Limnephilidae
    1 unidentified species among submerged grasses along banks of river.
Lepidoptera
    Arctiidae - larvae of 1 species from unrecorded shrub.
    Noctuidae - larvae of several species in soil and litter samples.
    Coleophoridae

Table XII-4 (Contin.)

        - *Coleophora fuscedinella* (Zell.) - on birch (casebearers)
        - Casebearer sp. - on alder
    - Hymenoptera
        - Chalcidoidea - 3 species in litter.
        - Ichneumonidae - 3 species in litter and rotting logs.
        - Pteromalidae
            - Hemadas nubilipennis (Ashmead) - galls on *Vaccinium*
        - Formicidae
            - *Camponotus herculeanus* F. - in and under rotting logs.
            - *Formica Sanguinea submuda* Emery - colony in log.
            - *Tapinoma sessile* (Say) - Emery - Several large colonies in litter.
            - *Leptothorax candensis* Prov. - in litter.
            - *Myrmica lobicornis*
            - *M. brevinodis* Emery - 1 male alate.
- Diptera
    - Simuliidae
        - *Simulium decorum* Walker - biting humans.
        - *S. corbis* Twin - biting humans.
    - Bibionidae
        - *Bibio* sp.
        - *Hesperinus brevifrons* Walker - flying over moist soil and along paths.
        - Many larvae (Bibio sp.?) in deciduous litter.
    - Calliphoridae - 1 specimen.
    - Muscidae - 1 species
    - Anthomyiidae - 1 species
- Diplopoda - 1 species in alder and willow litter.
- Chilopoda
    - *Lamyctes fulvicornis* Meinert - under rock on mineral soil.
    - *Lithobius forficatus* (L.) - in decaying logs.

Table XII-4 (Contin.)

Arachnida

Pseudocorpionida - 1 species in spruce - Kalmia litter.

Acari - many species seen. Not collected or identified.

Phalangida - one species in litter.

Araneida - many species seen but not collected or identified.

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Section XIII

INTERTIDAL MARINE INVERTEBRATES AND FISH

The Terra Nova National Park coastline displays a wide variety of marine fauna whose distribution (zonation) is dependent upon a combination of factors including exposure, substrate, slope, estuarine influence and seasonality (Hunter, et al, 1979). Exposed coasts (Copper Island and East Point, Swale Island) have the widest zonation pattern while sheltered areas (Broad Cove and Southwest Arm) show the most compressed pattern. Seasonality is also an important factor as it determines the occurrence of species with respect to different times of the year. Table XIII-1 indicates seasonal changes in the marine environment of Terra Nova National Park. The distribution of marine fauna is also strongly influenced by varying local abundance of grazers or predators.

Ice scouring which removes most plant and animal growth is the most important influence on Terra Nova National Park shores. Following such damage, zonation is dominated by a usually short-lived succession of animal species. Intermediate exposure locations differ from the more exposed locations largely by the reduction of species biomass and diversity. The shore often has quite extensive beds of Fucus and Ascophyllum which end sharply near the lowtide level. The subtidal substrate appears rather bare because of the grazing activities of Littorina littorea and sea urchins.

Table XIII-1

Seasonal Changes In The Marine Environment

Seasonal Oceanographic Events

Water Temperatures
- Cold Surface Water Temperatures (-1 to 1°C)
- Warm Surface Water Temperatures
- Arctic Temperatures at 50 fm (-1°C)

Coastal pack Ice

Plankton Blooms

Spawning/Breeding Occurrences

Capelin
- occur near shore
- Spawning (beach)
- Planktonic capelin larva

Cod
- Spawning
- Spawn offshore
- Move towards shore pelagically
- Follow capelin to shore

Lobster
- Moulting (growth)

Razor clams
- Spawning

Shorthorn Sculpin
- Spawning
- Embryogenisis with male guarding eggs
- Hatching

Shrimp (*Pandalus borealis*)

Spider Crab
- Egg hatching

Winter Flounder
- Spawning

Sea Birds
- Raise young coincident with capelin spawning

Barnacle
- Breeding
- Spawning and settlement of young

Scallops (*Placopecten*), Clams, *Mya arenaria*, *Petricola*, *Nemalion*
- Reproduction of warm water species temperatures permitting

Most Arctic type species

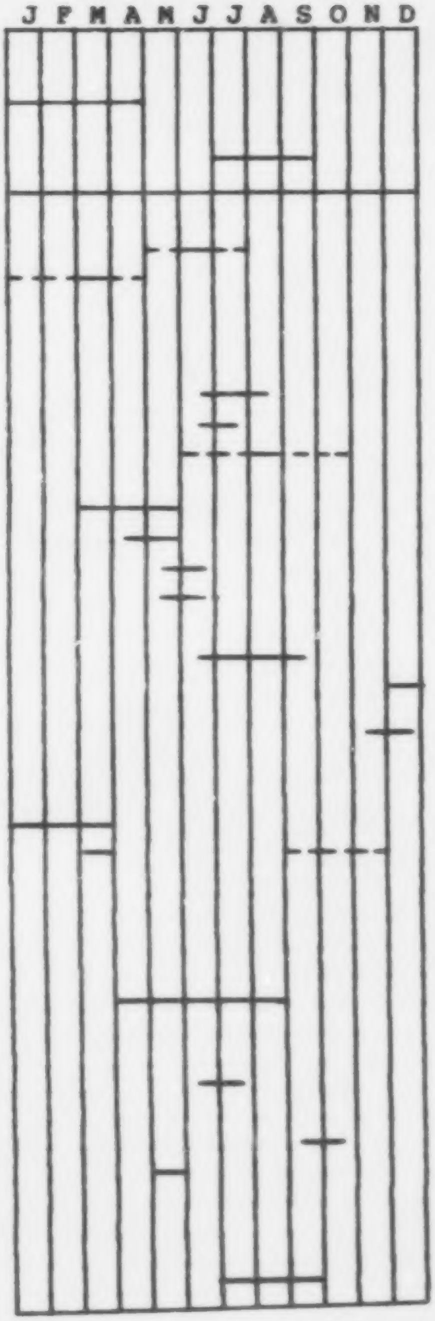


Table XIII-1 (Contin.)

Spawning/Breeding Occurrences (cont'd)
- Major growth and reproduction period

Young Harbour Seals
- on shore
- Born and suckling

Seasonal Marine Animal Occurrences

American Lobster
- migrate to upper subtidal

American Smelt
- Move into the estuaries

Bluefin Tuna
- occur in offshore waters

Cod
- Move inshore

Eels (young)
- Move into estuaries

Jellyfish
- Are abundant inshore

Mackerel
- Are present in Terra Nova National Park waters

Eelpouts
- Move into the nearshore

Salmon
- Migrate along the coast

Spiny Dogfish (Shark)
- Are present in offshore waters

Squid
- Move inshore

Winter Flounder
- Are present in offshore waters

Seals
- occur in coastal waters of Terra Nova National Park
- Harbour
- Harp

Sharks
- Occur in coastal water of Terra Nova National Park
- Basking
- Blue (South Coast inshore)
- Porbeagle

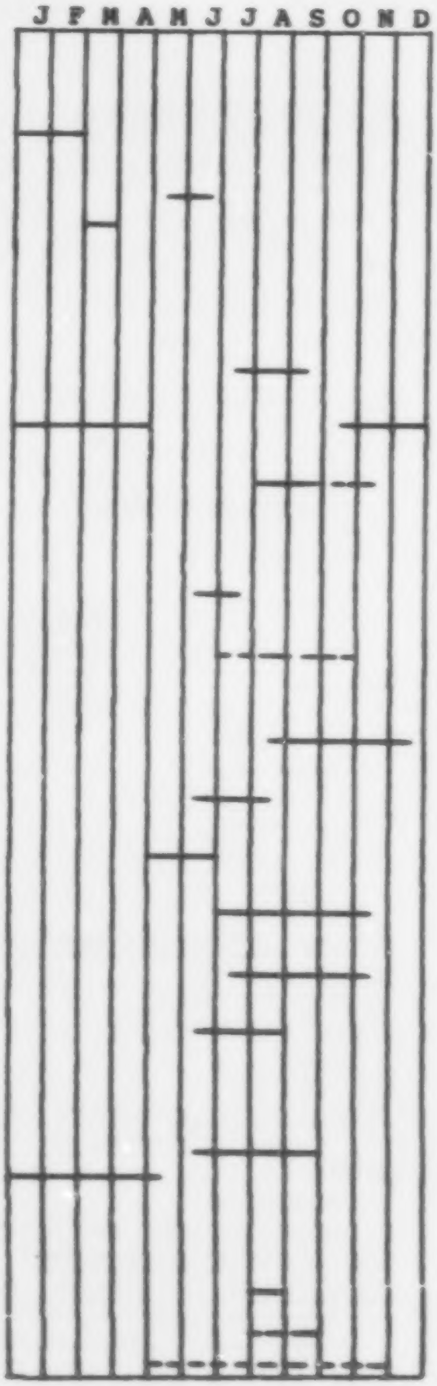
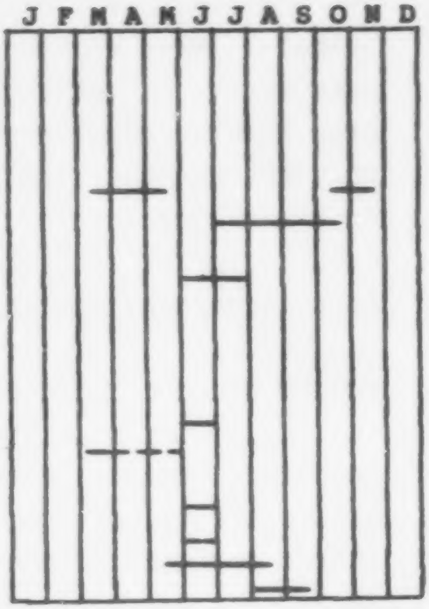


Table XIII-1 (Contin.)



Seasonal Marine Animal
Occurrences (cont'd)

Dolphins
- Occur in coastal waters of Terra Nova National Park
- Whitebeaked Dolphin (Squid-hound)
- Whitesided Dolphin (Jumper)

Porpoise
- Occur in Coastal Waters of Terra Nova National Park

Whales
- Occur in coastal waters of Terra Nova National Park
- Baleen Whales
- Bottlenose Whale (Subarctic Waters)
- Killer Whales (Pass offshore)
- Minke (Rorqual)
- Pilot Whales (Peak birth Period)
- Pothead Whales (Births)

An interesting marine biological feature of Terra Nova National Park is the presence of both "arctic" and warm water animals. Many of the former survive in the permanently cold deep water, but others occur in the shallows. These animals grow and reproduce when water temperatures are cold enough, then survive the warm season in a reduced or dormant stage. An example is the sea cucumber Psolus phantapus.

Benthic Animals of Terra Nova National Park

PORIFERA Sponges

The eight species of sponges identified in Terra Nova National Park are the area's main plankton consumers. Cliona is the most common species and is found throughout much of Terra Nova National Park, except in the estuaries. This boring sponge can cause severe damage to the scallop and mussel shells that it bores into. Clathrina, Halichondria and Scypha are also common around much of the park while others including Haliclona and Myxilla are more localized.

CNIDARIA Coelenterates

Three important classes of coelenterates are important in Terra Nova National Park.

Class Hydrozoa Hydroids, etc.

Over twenty species of hydrozoans are known to occur in Terra Nova National Park. They are most common on the more exposed parts of the park where they are important predators on copepods and other small animals. Clava, Dynamean, Gemmaria, and Obelia are common throughout the park, growing mostly on brown seaweeds such as Ascophyllum and Fucus and rocks.

Class Scyphoza Jellyfish

The Moon Jelly (Aurelia) and Red Arctic Jellyfish (Cyanea), both important plankton predators, are the most common jellyfish in the Terra Nova National Park area. Haliclystus auricula and H. salpinx are the two most common Stauromedusae in Terra Nova National Park, while two other species (Lucernaria and Thaumatoscyphus) are also known to occur.

Class Anthozoa Anemones, corals, etc.

Nine species of anthozoans are known to occur in Terra Nova National Park waters with Metridium, a major plankton predator, being extremely common. Tealia and Bunodactis, two large green anemones, are important benthic predators of the open coast. Burrowing anemones, Cerianthus and Edwardsia, are locally very common and are important predators. The only coral type organism observed in the park so far is the soft coral, Gersemia, which is not sufficiently common to be very significant to the park.

As a general group, the Cnidaria are one of the most important predatory influences on the Terra Nova National Park marine ecosystems.

PLATYHELMINTHES Flatworms

Flatworms comprise a little known portion of Terra Nova National Park's marine ecosystems and apparently have only minor ecological importance. Most Terra Nova National Park species are microscopic.

NEMERTEA (=Rhynchocoels) Nemertean worms

While only a dozen or so species of these worm-like animals occur in Terra Nova National Park, they can be a major predator in particular communities. Several Lilneus species occur under intertidal rocks, while others occur in sediments where they prey mainly on polychaete worms.

NEMATODES Rotifers, Wheel animals

Although present in Terra Nova National Park's coastal areas, there is little information available on their occurrence and distribution in the park.

ROTIFERA

Although present in the park, rotifers are probably not a major component of Terra Nova National Park food chains.

ANNELIDA Segmented worms

Several classes of annelids are present along the marine coast of Terra Nova National Park.

Class Polychaeta Spiny worms

Several types of polychaete worms including Arenicola, Eulalia, Nereis spp., Pectinaria and Sabella are common along Terra Nova National Park shores. Myxicola is the most common Terra Nova National Park example which can be a significant filter feeding component of food webs. The small coiled Spirorbis is often a major component of intertidal systems in Terra Nova National Park as they are an important recycler in food webs, as well as being locally important for turning over bottom sediments.

Phyllodocid worms are well adapted for predatory activities along the surface of soft muds, such as in front of the Headquarters Wharf in Newman Sound or in the sheltered basins in Lions Den or in Park Harbour.

Many families of annelids are common in Terra Nova National Park benthic marine communities and are extremely important in food webs as predators, filter feeders, scavengers, recyclers and are a major food item for carnivores, including many of the commercial species. On Terra Nova National Park sedimentary bottoms, they are the most diverse and abundant group of organisms.

MOLLUSCA Moluscs

Class Amphineura Chitons

There are only three common species of chitons found in Terra Nova National Park, but they are important in assisting the growth of corallines by removing plants and animals which grow on the surface and by removing the surface layers which otherwise impede growth. The Northern White Chiton (*Stenosemus albus*) is found on most non-estuarine Terra Nova National Park shores, while the Mottled Red and Red Northern Chitons, (*Tonicella marmorea* and *T. ruber*) are especially common on subtidal corallines on all the Terra Nova National Park shores but the estuarines. These two species are eaten by crabs, shrimps and other animals.

Class Gastropoda Univalves, Snails

Over thirty species of gastropods occur in Terra Nova National Park. These important grazers include periwinkles (*Littorina* spp.), limpets (*Acmea*), chink shells (*Lacuna* spp.), and top shells (*Margarites* spp.). Significant predators include dog whelks (*Nucella*), the moon snail (*Polynices*), and the northern whelk (*Buccinum*).

Littorina spp. are among the most ecologically important intertidal animals found in Terra Nova National Park with *L*. littorea being the most common. Its abundance makes this one of the main grazers limiting seaweed growth. *L*. *obtusata* also feeds on seaweeds (*Fucus* and *Ascophyllum*) and is sometimes a major food source for shorebirds. *L*. saxatilis is a main grazer of the high intertidal zone limiting most algal and lichen growth. It can withstand dessication, high temperatures, extreme salinity, or fresh water better than almost any other animal in Terra Nova National Park.

The tortoise shell limpet (*Acmea* *testudinalis*) is the common limpet found in Terra Nova National Park and contributes to the rather barren appearance of many shores by removing most young algae before they reach significant size.

The whelks (*Nucella*, *Buccinum*) are important predators of bivalve molluscs (e.g., *Mytilus*) and barnacles (*Balanus*). *Buccinum* *undatum*, the Northern Whelk is the most common *Buccinum* species and it also often feeds on offal. Shores with large populations of Dog Whelks (*Nucella*) tend to keep *Mytilus* and Balanus populations low, making the space available for colonization by plants.

The Moon Snail (*Polynicesheros*) is the largest shell in Terra Nova National Park and is therefore the last size available to the largest hermit crab (*Paglurus* *acadianus*). It may be found in any of the sand, *Zostera* bed type locations in Terra Nova National Park.

Class Bivalvia Clams, Mussels, etc.

Over twenty-five species of bivalves occur in Terra Nova National Park, making them a very important component of Terra Nova National Park ecosystems as plankton feeders, food recyclers and food for many carnivores. The dead shells are also an important substrate for algae and animals.

The Blue Mussel (Mytilus), Razor Clam (Ensis) and Soft Shell Clams (Mya) are among the most common bivalves and are found around all park shores. Other common species include the Prickley Jingle Shell (Anomia), the Iceland Cockle (Clinocardium), the Arctic Saxicave (Hiatella) and the Arctic Wedge Clam (Mesodesma), and the Northern Propeller Clam (Chlamys islandicus).

The Grant Scallop (Placopecten megallanicus) and the Iceland Scallop (Chlamys islandicus) are also present but their numbers are not commercially significant. The Giant Scallop is the most common scallop in our area but occurs locally and should be protected from over utilization by sport divers because beds will take many years to recover. None of the other bivalves on the Terra Nova National Park coast are present in large enough numbers to be of commercial value.

CEPHALOPODA

The Newfoundland squid, (Illex illecebrosus), is the most common cephalopod in the area of Terra Nova National Park while the Bottle Ass Squid (Rossia) and the octopus (Bathypolypus) occur in deep waters in Newman Sound and Clode Sound.

The Newfoundland Squid (Illex) is very common in Newman Sound in some years and almost totally absent in others. They eat large quantities of small fish and crustaceans and, in turn, are important food to pothead whales, birds, fish, etc.

ECHINODERMATA

Class Crinoidea Sea lilies

The only member of this class present in the park is Heliometra glacialis. They are of more interest than ecological importance in Terra Nova National Park.

Class Asteroidea Sea stars, starfish

Asteroids, which are active predators, are a very important component of Terra Nova National Park marine ecosystems. The common sea star (Asterias vulgaris) is the most common intertidal and shallow subtidal sea star in Terra Nova National Park from the estuaries to the open coast and is one of the main controls on low intertidal mussels, barnacles, clams etc.. Leptasterias, Crossaster, and Solaster are also major subtidal predators and are fairly common. The Blood Stars (Henricia) are also common throughout Terra Nova National Park waters, except the estuaries. They are frequently found on sponges and feed on particulate matter including plankton.

Class Ophiuroidea Brittle Stars

The serpent star (Ophiopholis aculeata) is an important component in Terra Nova National Park food webs because of the amount of plankton this species consumes. They occur throughout Terra Nova National Park on all but the estuarine shores and on coralline bottoms especially they may be present in very high numbers (120/m^2 or more). The brittle star is also a major prey species of many marine carnivores including the lobster and codfish. The other common brittle star in Terra Nova National Park, Ophiura, is an important predator on deep mud bottoms.

Class Echinoidea Sea Urchins, Sand Dollars

The green sea urchin (Strongluocentrotus drobachiensis) is the most widespread and abundant animal in Terra Nova National Park coastal waters, except in the estuaries. Besides being an important grazer, they are an important source of food for fish, birds, and other high carnivores. The sand dollars (Echinarahnius) are less important than the urchins, but are still a significant component of Terra Nova National Park marine ecosystems as major grazers on many sand bottoms and as food for fish. Both species are common throughout the park.

Class Holothuroidea Sea cucumbers

The sea cucumbers, (Chirodota, Cucumaria, & Psolus) are all a significant, though minor, component of Terra Nova National Park marine ecosystems. All species favour the outer portions of the park and most may be observed at all times of the year. Psolus phantapus is the one exception as it occurs only during the spring plankton bloom.

TUNICATA

Class Appendicularea Larvaceans

Although there is little data on the larvaceans in Terra Nova National Park, they are often one of the dominant grazers and the main agent ending phytoplankton blooms. When common, they are eaten by small fish and other predators.

Class Ascidiacea   Sea squirts

Ten species of sea squirts are known to occur in Terra Nova National Park with the orange sea squirt or sea peach, Halocynthia pyriformis, being the most conspicuous in the park. This species usually occurs in fairly exposed locations. Ascidia, Boltenia, Didemnum, and Molgula are also common throughout the park and form a significant component of the Terra Nova National Park marine ecosystems.

HEMICHORDATA   Acorn worms

Only two species of acorn worms are known in Terra Nova National Park waters and they are of very minor significance other than general interest in such an unusual group of animals.

ARTHROPODA

Class Pycnogoida   Sea spiders

Only two species of pycnogonids occur within Terra Nova National Park (Achelia scabra and Nymphon longitarse) and they play a minor role as predators of hydroids, bryozoa, and other small animals.

Class Crutacea

Order Cumacea

Cumaceans are common in sedimentary areas in Terra Nova National Park but are not known to be of major ecological importance.

Order Isopoda

Five species of isopods occur in Terra Nova National Park but they are not sufficiently abundant to be of particular ecological importance. The cod louse, Aega psora, is a fairly common parasite found on the skin of codfish jigged off Terra Nova National Park while the only other noticeable isopod in the park is the gribble, Limnoria lignorum, which may be found infesting most intertidal and subtidal wood.

Order Amphipoda

Amphipods are an important component of Terra Nova National Park marine systems with over twenty species occurring in the park. Calliopius laeviusculus is the most common amphipod in Terra Nova National Park and is found in all but the most sheltered areas. In late summer and fall it forms great swarms along the more exposed coasts where it is fed upon by fish and other carnivores. The most common caprellid amphipod in Terra Nova National Park is Aeginina longicornis and it is found on algae, hydroids and bryozoans in all but the most estuarine parts of the park. Gammarus spp. are widespread in Terra Nova National Park waters, especially in the more sheltered and estuarine locations, as are Monoculodes spp. which are found on most sandy, muddy or gravelly bottoms in Terra National Park. Most of the other amphipod species known to occur in the park are not widespread or were restricted to only a few areas.

Order Mysidacea

Although only a few mysid species are known to occur in Terra Nova National Park, they occur in large schools and are important grazers. They are food for many fish, birds and other organisms. Mysis mixta and Mysis stenopleis are two of the most noted species and are usually found in shallow water in the less exposed bays in Terra Nova National Park.

Order Euphausiaceae

Euphausids or krill are planktonic grazers which are mainly important in deeper offshore areas where they are eaten by whales, fish, birds and other carnivores.

Order Cirripedia Barnacles

The common rock barnacle, Balanus balanoides, is the most common intertidal barnacle in Terra Nova National Park on all shores. Populations may be devastated by ice action but recovery is usually quite rapid. They are eaten in large numbers by the dog whelk (Nucella). Two other Balanus species also occur in Terra Nova National Park and are found in moderately exposed areas.

Order Decapoda Crabs, Shrimps, Lobsters

Fourteen species of decapods are known to occur in Terra Nova National Park comprising a major component of the area's marine systems. The lobster, Homarus americanus, is the only member of direct commercial importance at the moment in Terra Nova National Park. The common rock crab, Cancer irroratus, is common along all the Terra Nova National Park coast as are several species of shrimp, spider crabs and hermit crabs.

The sand shrimp, Crangon septemspinosus, appears almost invisible in the Zostera - sand bed areas where it most commonly occurs. It feeds upon polychaete worms and is preyed upon by eels and birds. Two species of Eualis are also common in Terra Nova National Park waters as are two of Pandulus and several species of red striped shrimp (Spirontocaris). Spirontocaris spp. are quite important in benthic food webs.

Spider crabs (Hyas) and hermit crab (Pagurua) are also common in Terra Nova National Park waters and Hyas species in particular are a major food source of fish, sea birds, lobsters, mink, and otters.

The lobster is a conspicuous and important component of the park's marine ecosystems however Terra Nova National Park is close to the northern limit for lobsters.

Class Insecta

There are no true marine insects, but several are important to the intertidal zone. Several chironomids and other insects breed in the intertidal. Their larvae usually feed off small algae such as Enteromorpha, Ulothrix, Ulva and others. Several types of flies live on the seaweed and other wastes tossed ashore on the beaches. During most of the summer, rotting weeds high on the shore will contain the maggots of these flies. Other insects thrive in the estuaries and salt marshes.

BRYOZOA Moss animals

Several hundred species of bryozoans probably occur in Terra Nova National Park and are likely a significant filter feeding component of the food webs. They are eaten by molluscs, crabs, nematodes and other animals. Lichenopora, Membranipora, Tubilipora and Electra species are among the more common bryozoans in the park.

BRACHIOPODS **Lampshells**

A few species of brachiopods occur in Terra Nova National Park, where they are filter feeders. They are too rare to seem very important to marine ecosystems.

Table XIII-2 is a species list of benthic marine animals found in Terra Nova National Park:

Table XIII-2

Species List of Benthic Marine Animals Found in Terra Nova National Park

English Name	Scientific Name	French Name
PORIFERA		
	Cladocroce ventilabrum	
	Clathrina coriacea	
Boring Sponges	Cliona celata	Clione
Crumb of Bread Sponge	Halichondria panicea	Halichondrie
Finger Sponge	Haliclona oculata	
	Myxilla incrustans	
	Scypha ciliata	
CNIDARIA: HYDROZOA		
	Abilentilnaria abietina	Abietinaire
	Aeginopsis laurentii	
Splendid Aydromedusa	Aglantha digitale	
	Bougainvillia superciliaris	
	Campanularia integra	
	C. johnstoni	
	Clava multicornis	
	C. leptoslyla	
	Dynamean pumila	

Table XIII-2 (contin.)

	Eudendrium rameum	
	E. annulatum	
	Gemmaria costat	
	Hydractinea echinata	Hydractinie
	Hydralmannia distans	
	Lafoea fruticosa	
	Obelia geniculata	
	O. longissima	
	Sertularella polyzonias	
	Sertularia cupressina	
	S. tenera	
	Tubularia indivisa	
	T. larynx	Tubulaire
SCYPHOZOA		
Moon Jelly	*Ayrekua aurita*	Aurelie
Sea Blubber, Red Arctic Jellyfish	*Cyanea capillata*	Cyanee capillaire
	Haliclystus auricula	
	H. salpinx	
	Lucernaria quadricornis	
	Thaumatoscyphus atlanticus	
ANTHOZOA		
	Bunodactis stella	
	Cerianthus borealis	
	Edwardsia gracilis (?)	
Sea Strawberry	*Gersemia rubiformis*	
	Metridium senile	Oillet de mer
	Peachis parasitica	
	Stomphia carneola	

Table XIII-2 (contin.)

	S. coccinea	
	Tealia felina	
MOLLUSCA: AMPHINEURA		
Northern White Chiton	Stenosemus albus	
Mottled Red Chiton	Tonicella marmorea	Chiton rouge marbre
Red Northern Chiton	T. ruber	
GASTROPODA		
	Acanthodoris pilosa	
Tortoise Shell Limpet	Acmea testudinalis	Acmee a ecaille de tortue
Northern Admete	Admete couthouyi	Admete commune du Nord
	Aeolidia papillosa	
Pelican's Foot	Aporrhais occidentalis	Pied-de-pelican
Northern Whelk	Buccinum undatum	Buccin commun
	B. spp.	
Sea Butterfly	Clione lamacina	
	Dendronotus frondosus	
	Doto coronata	
Salt Marsh Spire	Hydrobia minuta	Hydrobie miniscule
	Ilyanassa obsoleta	
Pale Chink	Lacuna pallidula neritoidea	Lacune pale
Chinkshell	L. vincta	Lacune commune de l'Atlantique
Periwinkles	Littorina littorea	Vignot
Smooth Periwinkle	L. obtusata	Bigorneau jaune
Northern Rough Periwinkle	L. saxatilis	Bigorneau brun
Sea Butterfly	Limacina helicina	

Table XIII-2 (contin.)

Noble Bela	Lora nobilis	Bela noble
Smooth Top Shell	M. costalis	Troque rose du Nord
Dog Whelk, Dog Winkle	Nucella lapilla	Pourpe
	Onchidoris adspersa	
False Angel Wing	Petricola pholadiformis	Petricole Pholadiforme
Moon Snail	Polynices heros	
Little Puncturella	Puncturella noachina	Petite patelle percee
Orb (or Trumpet)	Skenopsis planorbis	Skenee planorbe
	Tachyrhyncus sp.	
Needle Shell	Turritellopsis acicula	Turritelle aique
Striped Velvet Shell	Velutina undata	Veloutee rayee
Common Velvet Shell	V. laevigata	Veloutee commune
PELECYPODA=BIVALVIA		
Prickly Jingle Shell	Anomia aculeata	Anomie epineuse
Ocean Quahog	Arctlica islandica	Quahaug de mer
Waved Astarte	Astarte undata	Astarte ondulle
	Astarte spp.	
Iceland Scallop	Chlamys islandicus	Petoncle d'Islande
Iceland Cockle	Clinocardium ciliatum	Coque d'Island
Faba Crenella	Crenella faba	Crenella fauve
	C. glandula	
Northern Propeller Clam	Cyrtodaria siliqua	Couteau de Banks
Razor Clam	Ensis directus	Couteau droit
Amythest Gem Clam	Gemma gemma	Gemma amethyste
Arctic Saxicave	Hiatella arctica	Saxicave arctique
Striated Samilcave	H. striata	

Table XIII-2 (Contin.)

Little Macoma	*Macoma balthic*	Petite macoma
Arctic Wedge Clam	*Mesodesma arctatum*	Mesodesme arctique
Soft Shell Clam	*Mya arenari*	Mya commune
	M. groenlandicus	
	M. helicinus	
Truncate Soft Shell Clam	*M. trucata*	Mya tronquee
Blue Mussel	*Mytilus edulis*	Moule bleue
Giant Scallop	*Placopecten megallanicus*	Petoncle geant
Greenland Cockle	*Serripes groenlandicus*	Coque du Groenland
Surf Clam	*Spisula solidissima*	Mactre de l'Atlantique
Shipworm	*Toredo nivalis*	Taret commun
Dwarf Turton Clam	*Turtonis minuta*	Turtonia nain
Northern Heart Shell	*Venericardia Borealis*	Venericarde boreale
CEPHALOPODA		
	Bathypolpus sp.	
Newfoundland Squid	*Illex illecebrosus*	
Bottle Ass Squid	*Rossia* sp.	
ARTHROPODA: PYCNOGONIDA		
	Achelia scabra	
	Nymphon longitarse	
CRUSTACEA		
CIRRIPEIA		
Common Rock Barnacle	*Balanus balanoides*	Balane commun
Northern Ridged	*B. balanus*	Balane costule du Nord
Norched Acorn Barnacle	*B. crenatus*	Balane crenele

Table XIII-2 (Contin.)

MYSIDACEA		
	Mysis mixta	
	M. stenopleis	
ISOPODA		
Cod Louse	*Aega psora*	
	Idothea baltica	
	Jaera ischiosetosa	
	J. marine	
Gribble	*Limnoria lignorum*	
DECAPODA		
Common Rock Crab	*Cancer irroratus*	Crabe-tourteau commun
Queen or Snow Crab	*Chinoncetes opilio*	
Sand Shrimp	*Crangon septemspinosus*	
	Eualis fabvrici	
	E. pusiolus	
American Lobster	*Homarus americanus*	Homard d'Amerique
Large Spider Crab	*Hyas areneus*	
Small Spider Crab	*H. coarctatus*	
Hermit Crab	*Pagurus acadianus*	
	p. arcuatus	
	P. pubescens	
	Pandulus borealis	
	P. montagui	
	Spirontocaris spp.	
AMPHIPODA		
	Aeginina longicornis	
	Amphithoe rubricata	
	Calliopius laeviusculus	

Table XIII-2 (contin.)

	Caprella spp.
	Corophium sp.
	Dulichia sp.
	Gammarellus angulosus
	Gammarus oceanicus
	G. setosus
	Hyperia medusarum
	Jassa falcata
	Metopa spp.
	Monoculodes longirostris
	M. Tuberculantus
	Orchomonella pinguis
	Paramphithoe hystrix
	Paroediceros lynceus
	Parathemisto sp.
	Phoxocephalus holbelli
	Pleustes panoplus
	Pontogeneia inermis
	Syrrhoe crenulata
BYROZOA	
	Aeta anguina
	Alyconidium spp.
	Celleporina ventrisosa
	conopeum reticulum
	Cystisella saccata
	Electra pilosa
	Eucratea loricata
	Flustrellidra hispida
	Idmonea atlantica
	Lichenopora hispida
	L. verrucaria
	Membranipora serrulata

Table XIII-2 (contin.)

	Parasmittina jeffreysi	
	Tegella armifera	
	tubilipora sp.	
TUNICATA: APPENDICULARIA		
	Larvaceans	
	Fritillaria borealis	
	oikopleura spp.	
ASCIDIACESE		
Sea Squirts	Amouroucium pallidum	
	Ascidia callosa	
	Boltenia echinata	
Clear Sea Squirt	Ciona intestinalis	
	Dendrodoa carnea	
	Didemnum albidum	
	Halocynthis pyriformis	
	Molgula citrina	
	Molgula spp.	
	Trididemnum tenerum	
ECHINODERMATA: ASTEROIDEA		
Common Sea Star	Asterias vulgaris	Etoile de mer pourpre
Rough Sunstar	Crossaster papposus	
Basket Star	Gorgonocephalus arcticus	
Blood Stars	Henricia eschrichtii	
	H. sanguinoleta	Petite étoile rouge
	H. scabrior	
Polar Starfish	Leptasterias polaris	Astérie à six bras
Arctic Cushion Star	Pteraster militaris	
Purple Sunstar	Solaster endeca	

Table XIII-2 (contin.)

OPHIUROIDEA		
Serpent Star	*Ophiopholis aculeata*	
	Ophiura robusta	
	O. sasrsi	
ECHINOIDEA		
Common Sand Dollar	*Echinarachnius parma*	Petit clypèaster
Green Sea Urchin	*Strongluocentrotus drobachiensis*	Oursin commun
Whore's Eggs		
Horse's Eggs		
CRINOIDEA		
Sea Lilies	*Heliometra glacialis*	
ANNELIDA: POLYCHAETA		
Bristle Worms	*Amphitrite* spp.	
Lugworm	*Arenicola marna*	Arènicole
	Antolytus cornutus	
	Dodecacaria concharum	
	Eulalia bilineats	
	E. viridis	
	Fabricia sabella	
	Glycera capitata	
Scale Worms	*Harmathoe imbricata*	
Scale Worms	*Lepidonotus squamatus*	Hermione
	Maldane sarsi	
Blue Fanworm	*Myxicola infundibulum*	
	Nephthys spp.	Nèrèide
Trumpet Worm	*Pectinaria gouldi*	
	Pherusa plumosa	
	Phullodoce spp.	
	Polydora ciliata	

Table XIII-2 (contin.)

P. concharum
P. webster
Potamilla neglecta
Sabella spp.
Spirorbis spp.
S. borealis
S. spirillum
Tomopteris helgolandicus
Trichobranchus glacialis

Zooplankton of Terra Nova National Park

Several species of zooplankton occur in Terra Nova National Park although not much is known on their status. They form a vital link between phytoplankton, the primary source of food, and all other higher forms in the oceans.

COPEOPODS

Copepods are usually the most important primary grazers in planktonic food webs and species in Terra Nova National Park include Pseudocalanus, Oithona, Acartia and Calanuls.

Many of the zooplankton species present in Terra Nova National Park are merely larval stages of various marine benthic animals and are a major food source for fish, whales, etc.

Marine Fish of Terra Nova National Park

The Terra Nova National Park area has an assortment of commercial and non-commercial fish species typical of the east coast of Newfoundland. Important commercial species include the cod (Gadus morhua), herring (Clupea harengus), mackerel (Scomber scombrus), Atlantic salmon (Salmo salar), and capelin (Mallotus villosus).

In particular the capelin spawning time in June is a highlight of the marine biological year in the Terra Nova National Park area, although the main spawning beaches are outside the park boundaries.

Other common fish species include the american eel (Anguilla rostrata), tomcod (Microgadus tomcod), longhorn and shorthorn sculpin (Myoxocephalus), rock gunnels (Pholis gunnellis), winter flounder (Pseudopleuronectes), winter skate (Raja ocellata), and sea run brook trout (Salvelinus fontinalis). Several species of stickleback (Apeltes and Gasterosteus) also occur locally.

The cunner (Tautogolabrus) is the most common resident marine fish in Terra Nova National Park. Large numbers are seen everywhere along the coast from the estuaries to the open coast. The largest numbers are found between these extreme habitats while the largest fish, up to 2 kg. or more, are found at the most exposed locations.

Table XIII-3 is a species list of marine fish occurring in Terra Nova National Park:

Table XIII-3

Species List of Marine Fish Found in Terra Nova National Park

English Name	Scientific Name	French Name
CHORDATA		
CLASS VERTEBRATA		
Sandlance	Ammodytes americanus	Lançon d'Amèrique
Atlantic Wolffish	Anarhichas lupus	Loup atlantique
Spotted Wolffish	A. minor	Loup tachetè
American Eel	Anguilla rostrata	Anguille d'Amèrique
Four Spine Stickleback	Apeltes uadricus	Epinoche à quatre èpines
Herring	Clupea harengus	
Lumpfish	Cyclopterus lumppus	Gross poule de mer
Three Spine Stickleback	Gasterosteus aculeatus	Epinoche a trois èpines
Blackspotted Stickleback	G. Wheatlandi	Epinoche tachetèe
Atlantic Cod	Gadus morhua	Morue france
Atlantic Sea Raven	Hemitriptorus americanus	Hémitriptère atlantique
Atlantic Sea Snail	Liparis atlanticus	Limace atlantique
Ocean Pout	Macrozoarces americanus	Loquette d'Amèrique
Capelin	Mallotus villosus	Capelan
Tomcod	Microgadus tomcod	Poulamon atlantique
Longhorn Sculpin	Myoxocephalus octodecemspinosus	Chaboisseau à dix-huit èpines

Table XIII-3 (contin.)

Shorthorn Sculpin	M.scorpius	Chaboisseau à èpines courtes
American Smelt	Osmerus mordax	Eperlan d'Amerique
Rock Gunnel	Pholis gunnellus	Sigovine de roche
Winter Flounder	Pseudopleuronects americanus	Plie roughe
Ninespine Stickleback	Pungitius pungitius	Epinoche a neuf èpines
Winter Skate	Raja ocellata	Raie tachetèe
Atlantic Salmon	Salmo salar	Saumon atlantique
Sea Run Brook Trout	Salvelinus fontinalis	Omble de fontaine
Mackerel	Scomber scombrus	Maquereau blue
Arctic Shanny	Stichaeus punctatus	Stichèe arctique
Cunner	Tautogolabrus adspersus	Tanche-tautoque
Bluefin Tuna	Thunnus thynnus	Thon rouge
Radiated Shanny	Ulvaria subbifurcata	Ulvaire deux-lignes

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Section XIV

ARCHAEOLOGY AND HUMAN HISTORY

The record of human history in Bonavista Bay goes back to approximately 3000 B.C. The first evidence of prehistoric occupation was found at The Beaches (Tuck 1976) site, situated about 20 km. from Terra Nova National Park's western boundary. This and several other nearby sites at the head of Bonavista Bay (Carignan 1977) have shown evidence of three cultural traditions. A series of excavations in the region uncovered evidence of Maritime Archaic, Dorset Eskimo and Beothuk traditions at sites identified on Map XIV-1. More recent excavations in the Clode Sound area of Terra Nova National Park by Dr. James Tuck and his staff from Memorial University in 1979 and 1980 have revealed the first evidence of Early Dorset Eskimo occupation on the northeast coast. (Tuck 1980, Sawicki 1981)

Maritime Archaic

The earliest evidence of occupation dates back to around 3000 BC. This is the estimated date of arrival of the first bands of Indians on this coast. These Indians, part of what is known as the Maritime Archaic Tradition, depended principally on the sea and its resources for survival. Seals, whales, fish and seabirds were hunted for much of the year while some caribou, hares, beaver and otter were hunted, trapped or

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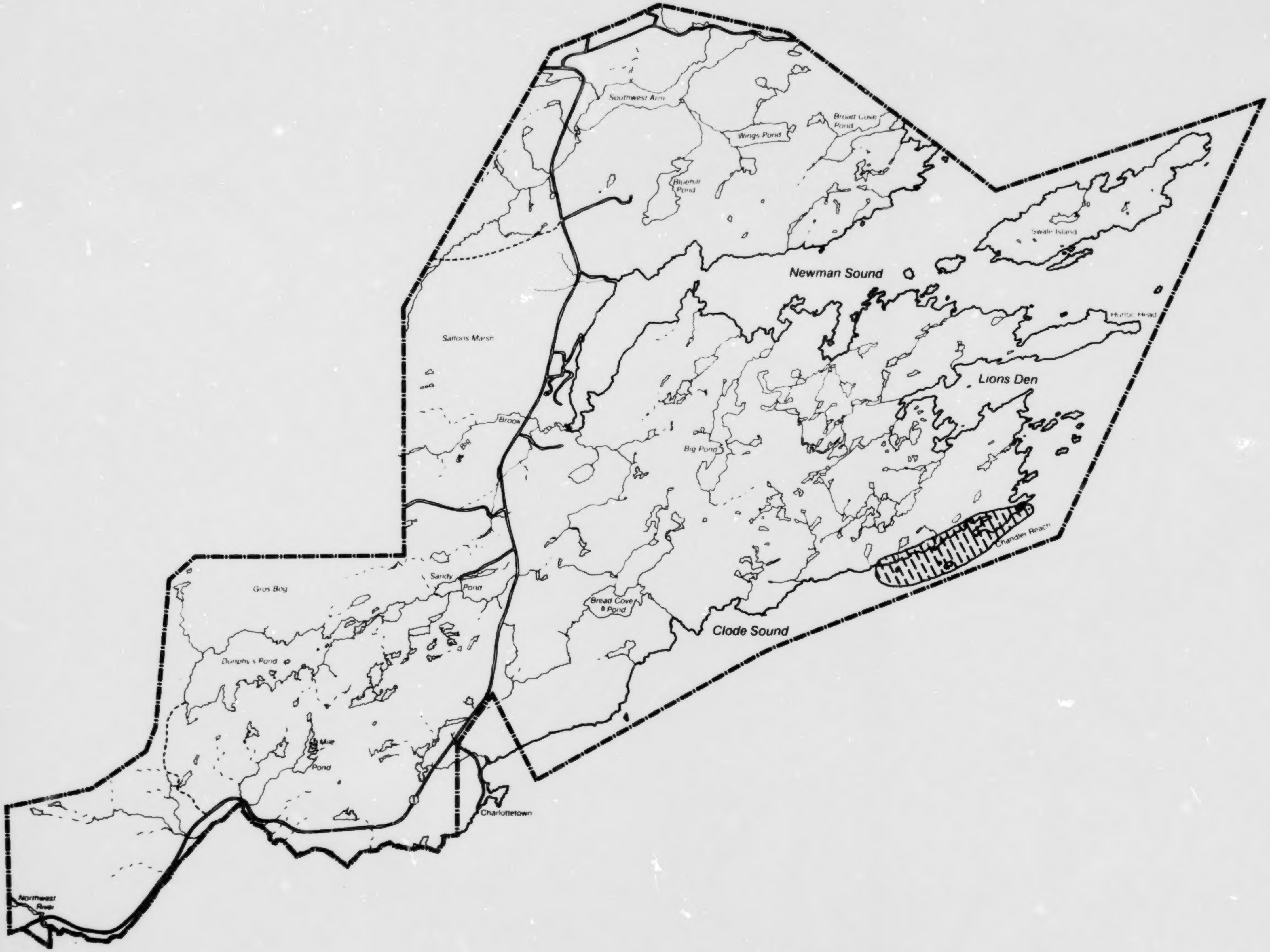
*5 Radiocarbon dates are calculated in years BP (before present) but for this section they have been converted to years AD/BC

Terra Nova National Park

MAP XIV-1

Location of Maritime Archaic,
Dorset Eskimo, And Beothuk
Sites In Terra Nova
National Park


Southwest Arm
Wings Pond
Broad Cove Pond
Bluehill Pond
Swale Island
Newman Sound
Salmons Marsh
Hurloc Head
Lions Den
Brook
Big
Big Pond
Chandler Reach
Sandy
Pond
Gros Bog
Bread Cove Pond
Clode Sound
Dunphy's Pond
Mile
Pond
Charlottetown
Northwest River

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

snared in the interior forests. Because of their dependence on the sea, most settlement sites for these Indian bands were on the coast or islands, especially near points where seals or whales would 'haul out'.

Currently available evidence suggests that the Maritime Archaic phase on the island of Newfoundland continued down to some time after 1500 BC. The latest radiocarbon date from any site of this tradition is 1280 ± 220 BC (the ± figure is a measure of the uncertainty that the dated material is this old. In effect it means that there is a 2 to 1 chance that the true date lies in the range 1500 - 1060 BC) at Port au Choix on the west coast of the Northern Peninsula.

Dorset Eskimo

Although the latest Maritime Archaic date from the island is well within the second millennium BC, it is not until almost 500 BC that substantial evidence of a new cultural and ethnic group in Bonavista Bay appears. Recently obtained dates from the Moose Pasture and Zodiac sites on Clode Sound provide the earliest evidence on the northeast coast of people known to archaeologists as Dorset Eskimos (Sawicki 1981). The Dorset Eskimos (so-named after the site on Cape Dorset where the tradition was first identified) had been expanding on to the island from the Labrador coast during the first half of the first millennium BC, establishing settlements on both the northeast and west coasts. These Eskimos lived much the same lifestyle, based on marine resources, as did the Indians whom they succeeded. This phase is known archaeologically as the Early Dorset.

After the initial expansion the Eskimo occupation of the north-east coast intensified through the period AD 1 to 500.

Dozens of settlements containing the characteristic Dorset types of stone artifacts (part of the Arctic Small Tool Tradition) belong to this phase known as the Middle Dorset.

Over the next few hundred years, however, the Dorset Eskimo gradually disappear from the archaeological record on the Island of Newfoundland, and by AD 1000 they were gone even from the Labrador coast.

Recent Indian

At Cape Freels, a very large site between Bonavista Bay and Hamilton Sound, a series of radiocarbon dates ranging between approximately AD 200 and AD 750 have been obtained from features identified as belonging to an Indian, rather than Eskimo, cultural tradition (Carignan 1977). Similar dates from similar contexts have been found also on the west coast at Cow Head. It seems, therefore, that, contrary to earlier assumptions, in Bonavista Bay as well as elsewhere, both recent Indian groups and Middle Dorset Eskimos used the same general areas at the same time and exploited the same resources for their survival.

Beothuks

We simply do not know whether or not the Beothuks were the direct ethnic and cultural descendants of the Indian groups of the first millennium AD. The types of stone artifacts found on Beothuk sites are very similar to those from Cape Freels but stone tool types and styles, by themselves, cannot prove either ethnic continuity or population replacement. Unfortunately, we have virtually no other types of evidence from Indian sites of the AD 200-1500 period.

Beothuks still occupied the area in 1575 (Such 1978), when the first European settlers started to appear in what is now Terra Nova National Park. European settlers were attracted to the same sheltered harbours and access to fresh water as their aboriginal predecessors and their superior firepower once more forced the Beothuks inland. The Beothuks may have survived the first seasonal occupations of the newcomers, but later European settlements were more aggressive and far-reaching in their designs and the days of the Beothuks were obviously numbered as settlements expanded. The Beaches site may well have been the location of a Beothuk massacre (O'Dea 1967), given the local names of Bloody Bay and Bloody Reach on contemporary maps of the Alexander Bay area. Archaeological work at The Sailors site verifies the existence of Beothuk communities in the Salvage area in the late 1500's and the community's name is reputed to derive from the Spanish word for savage, which was "salvaje". Some massacres occurred as the communities extended their areas of influence and another contributory factor in the decline of the Beothuks was the arrival of Micmac Indians from the Island's west coast in the 18th century. By the early 1800's Micmacs were well established at Clode Sound (Howley 1915) and were used as guides for hunting out the few remaining Beothuks, the last of whom died in 1829.

This bare bones chronological outline of the prehistory of the northeast coast of Newfoundland reveals the extent of our ignorance as much as the state of our knowledge. We can identify two distinct racial groups - Indians and Eskimos - and sub-divide these into periods, phases or traditions whose basic subsistence strategies can be generally stated. To some extent, when the archaeological environment encourages survival of the evidence, we can even see glimpses of the spiritual and religious dimensions of life on the

Newfoundland coasts and inferential evidence from settlement size, location and organization may lead us to some understanding of social structure and relationships.

We do not, however, except perhaps for the Dorset period, have enough sites with enough secure dates to know whether our basic understanding of culture history is correct. Is the gap in radiocarbon dates between the end of the Maritime Archaic and the start of the Dorset occupation on the northeast coast a genuine gap in the human use of this part of Newfoundland, or is it merely the result of archaeologists not having yet found the sites that would fill in the gap? Is it possible that the Zodiac site on Clode Sound should be interpreted as evidence of an overlap, or at least a meeting, of these two ethnic groups. If so, what sort of meeting? A clash, warfare, and the replacement of the Indian population by Eskimos? Or, perhaps, a sharing of the coast (even though both were exploiting the same resources) until the Eskimos began their retreat (? expulsion) after ca. AD 500 and Indians once again became the dominant racial group in the area? To all these questions the rather bland answer must be that further research is necessary. We can, however, reasonably expect that this further research will provide us with the answers (and probably some new questions, as well).

Less certain is whether further research will enable us to answer questions about the extent to which we can trace backwards in time the ancestors of Beothuks, in particular, and identify the existence of distinct ethnic divisions within the overall Indian and Eskimo racial groups. We know, for instance, of the Micmac arrival in the 18th century. Did similar population movements occur in the millennia before the arrival of Europeans? If so, when, from where and why? If not, why not? Did distinct ethnic/tribal divisions develop internally among the indigenous Newfoundland Indian and Eskimo traditions? If so, why, when, where? If not, why not?

We have a long way to go, then, before we can claim to have a firm understanding of the outline of Newfoundland culture history or of the relationships between and within the two major racial/cultural groupings. The Bonavista Bay area however, has been a remarkably fertile source of data for what we know so far. The bays and islands of this coast were particularly attractive to peoples who depended on marine resources for their survival and it is highly likely that sites remain to be found that will provide information crucial to our understanding of the prehistory of the area. It is essential, then, that the greatest attention be paid to any evidence of sites being damaged by coastal erosion and that close inspection be undertaken in advance of - and during - any development work in coastal areas. Even a site that is first discovered as just a few flakes or stone tools washing out of a bank or a concentration of charcoal and stones forming an ancient fireplace could contain the diagnostic tool types or provide the essential radiocarbon dates that would allow archaeologists to make major leaps forward in unravelling the puzzles of the past. So, no matter how unimportant the traces may seem to the casual viewer, it is important they be reported to the Archaeology Section of the Atlantic Region Office.

European Settlement

John Cabot almost certainly explored the waters around the park area in 1497 and may well have made his first landing here, although Portuguese and Spanish fishermen were probably present well before this time. Both Gasper Corte-Real in

1500 and Jacques Cartier in 1534 ventured into Bonavista Bay and initiated the first tentative explorations of the coast. Spain, Portugal, France and England all laid claim to the better harbours and coves near the cod fishing grounds. France and Portugal led the way in the early 1500's, but Spain was well established by the 1550's and England a dominant force by 1600.

The first colonizations by the British in the area around Salvage led to the first military confrontations in the area, which until then had been shared by the Beothuks and Spanish.

During the 16th and 17th centuries the English migratory fishery dominated Newfoundland's daily life from the desks of merchants in southwestern England ports. These families would provide the first permanent settlers a little later. Newfoundland's importance as a base for the cod fisheries was considered above that of any other east coast possession and was the source of most English-French rivalry on the American continent until the fur trade. At first the focus on the fishery was on the Avalon Peninsula, but by 1672 the first English settlements were established around Salvage. The censuses of 1676 and 1681 showed the early turnover of families and the seasonal nature of their occupation of the settlements, but logging and the fur trade gradually provided winter activities of sufficient benefit to make settlements more permanent. Conflicts between the French and English intensified in the next forty years, although the 1713 Treaty of Utrecht brought an uneasy peace to the area. Fishing rights were granted to the French in Bonavista Bay, despite the existence of English settlements, but fortunately the French preferred to concentrate on the fish stocks of Notre Dame and White Bays. The 1783 Treaty of Versailles remedied the problem by transferring all fishing rights to the English settlers.

By the end of the 1720's George Skeffington had established a salmon fishery in Bonavista Bay, although timber and furs offered the more usual reasons for site clearing. A 1755 grave at Bread Cove offers proof that a community was established there by that time (Jukes 1842). Furs were probably sold to American traders established at Bonavista and trade in seal skins and seal oil was very brisk in the late 1700's until the American Revolution cut off the market. This event also provided the impetus for more permanent settlements and the first English place names started to appear on maps of the area in 1775. However, full exploration did not take place until 1790, when Michael Lane's map indicated the full extent of Clode Sound.

The changes in the 19th century were vast and sweeping and established the era of permanent settlement. Another contributing factor was the disastrous series of famines after the Napoleonic Wars of 1812-15, which made settlement near the fish supply a necessity. The first record of permanent occupancy of Salvage dates from 1827 and five years later the community totalled 250, as did nearby Barrow Harbour. Most of the inhabitants came from the English county of Dorset by way of Bonavista, although a contemporary settlement of the Port Blandford area was by Micmacs. Bloody Bay, which eventually became Glovertown, was settled in 1834 around Richard Stroud's salmon fishery on the Terra Nova River and this community began its major growth in the 1850's, when Sandy Cove, Eastport and Happy Adventure were also established. Traytown followed about twenty years later at the same time as the first permanent English settlements on Clode Sound at Charlottetown and Port Blandford (Major

1979). The building of a railway through Port Blandford led to the start of Terra Nova in 1892 and the subsequent influx of loggers and sawmill operators.

The Labrador and seal fisheries were very important for local inhabitants in the park area, with woodcutting a major winter activity. Boat construction for the Labrador fishery was also very important on both Newman and Clode Sounds and large areas of forests were felled in a very short period of time after settlement. The Church of England and Methodist missionaries and ministers were very instrumental in establishing the first schools, but the first resident doctor did not arrive until 1897. The first roads were built as early as 1868, (Hibbs 1940) but transportation was almost entirely by boat until the arrival of the railway. Agriculture was important around Clode Sound and Eastport in the 1850's and Sandringham owed its existence almost one hundred years later to the farming community. However, the Labrador fishery was the main economic activity well into the mid 1900's, when the loss of markets and a trend towards fresh fish production led to its demise in 1954. Local fishermen also benefitted from the inshore cod, herring and squid fisheries and operated a substantial lobster fishery.

The next major change resulted from the rise of the forest industry in Newfoundland. The Glovertown-Traytown area was important first for its salmon fishery, but soon became the centre of a major pitprop operation. In 1921 there were 19 sawmills in the local area (Nfld. Dept. of Colonial Secretary, 1921) and this activity was expected to become even more pronounced with the announcement of the setting up of the Terra Nova Sulphite Company in the early 1920's. Unfortunately this company went into bankruptcy before starting operations. Pitprops continued to be cut along the shoreline of Southwest Arm in exchange for coal from Wales to run the Newfoundland Railway. An increase in lumbering activity and some shipbuilding helped the local economy, but a disastrous fire in 1946 destroyed most sawmill operations and negated a return to economic prosperity.

The Newman Sound area also benefitted directly from logging, with the first sawmill located at Minchin Cove in the late 1890's. Several other mills followed in the early 1900's and the Turner mill at Salton's Brook was a major operation, involving wood cut from North Broad Cove to Hurloc Head. Cutting took place mainly in the winter, but loading continued throughout the summer, when John Squire's pitprop operations were in full swing. Most of the wood was cut around Big Brook and in later years it was joined by two more mills, established by the Lane family at Upper Sandy Point and George Squire at what is now Headquarters Wharf. Both these operations were still in existence when the park was established in 1957.

Terra Nova was well known as the starting point for some of the Island's best caribou hunting, although the illfated Terra Nova Sulphite Company venture did initiate a logging industry that continued until 1962. Lumbering in Clode Sound was most pronounced in the early 1920's, with Weston Spracklin the major operator. His mill at Bread Cove marked the start of permanent settlement and gave the area an economic boost (Rosen 1977). There were also several other sites around Clode Sound and Lion's Den, including an important mill operated by the Readers at Park Harbour. The sawed timber was loaded for shipment to Conception Bay and included a high proportion of eastern white pine, which was at the time an important component of the area's boreal forest. Pelley's pitprop operation also provided employment for the Port Blandford area. The last operation actually started after most of the others had ceased in the late 1940's. Don and Les Spracklin's woods operation in the Cobbler's Brook-Tidewaters-Charlottetown-Bread Cove areas provided an important source of local employment until it was moved to the Gambo area in 1958.

Shipbuilding was also important in both Newman and Clode Sounds in the early 1900's. A total of five schooners were built in Newman Sound from 1925 to 1936, while the height of shipbuilding activity was reached in Clode Sound during and just after World War I. Steers Brothers Ltd. built five schooners in Clode Sound at this time and a similar number were constructed at Charlottetown.

The last major event in the life of the park area was the creation of Terra Nova National Park in 1957. Many of the local industries were experiencing a downturn in their fortunes and the creation of a major national park provided a counterbalance. Service industries now dominate the area, although the inshore fisheries are still important in waters adjacent to the park. Both aspects are likely to continue in importance, although the advent of offshore oil exploration could prove to have mixed blessings for the area.

Archaeological Research

Explorations by Paul Carignan in 1975 and 1977 established that coastal regions in Bonavista Bay were more likely to be productive for both aboriginal and European evidence than the interior. This conclusion was used to direct fieldwork in and around Terra Nova National Park in 1979 and 1980. The 1979 season began in October 1979 and lasted until the end of November, (Tuck 1980), while 1980 fieldwork was undertaken between late May and late June 1980 (Sawicki 1981). Survey parties investigated all sections of the coastline in 1979, both on foot and by boat. The coastal area, and especially the north shore of Clode Sound and Long Islands, was productive enough to warrant more intensive investigations in 1980. Artifacts, flakes and other material of aboriginal origin were collected and more recent European artifacts and features were noted and photographed. As a result of the two seasons' fieldwork, some tentative conclusions can be drawn as to aboriginal use of the Terra Nova National Park area.

The Maritime Archaic tradition was first recognized and named on the basis of excavations at a large burial ground at Port-au-Choix on the island's west coast in 1968. Since then several other sites, including those in Bonavista Bay, have been found and excavated. Maritime Archaic Indians probably occupied the region from northern Labrador to New England and covered several biotic provinces, which explains local specializations. The sea was, however, a common factor and played the major part in the provision of natural resources. Four major settlement sites were identified in the 1979 survey and two of these were more intensively studied in 1980. Artifacts collected established fairly important sites of occupation and included stone celts, ground slate lance or spear points, stemmed projectile points and chipped stone bifaces. Details of the various sites follow.

1. Zodiac (DdAk-3)
   This site is eroding from a gravel bar southwest of Shag Point on Chandler Reach and is interesting in having evidence on both Maritime Archaic Indian and Palaeo-Eskimo occupation. The site is about 1.5 meters above sea level but the bar is being rapidly undercut

by erosion and the lower Maritime Archaic component artifacts are being more rapidly displaced. The estimated age of the Maritime Archaic site is somewhere between 1000-2000 BC, but none of the artifacts recovered in 1980 were able to confirm this by radiocarbon dating. 1979 fieldwork produced chipped stones, two celts and a large flat ground scraper or knife. In 1980 the severe erosion had left no Maritime Archaic artifacts in situ, although Stratum 2 was considered to be a site of that culture and numerous identifiable artifacts and fragments were discovered. These included two ground slate lance fragments, a biface fragment and a retouched rhyolite flake from Stratum 1 (the Dorset Eskimo layer), a stemmed projectile point fragment, a biface fragment, five celt fragments, three slate fragments, a quartzite whetstone, a linear flake, two preforms of black chert and rhyolite, an oval spall and three retouched flakes of uncertain origin from Stratum 2, and a ground slate lance, a celt fragment, seven biface fragments and three retouched flakes from the surface. Wave-tossing and human disturbance have combined to make the vertical distribution of artifacts less than perfect, but enough remains on the site to distinguish evidence of at least three cultures, the earliest of which was the Maritime Archaic.

2. Celt (DdAk-4)
This site, which is located on a small island immediately north of the Zodiac site, may have been an offshoot of the main Maritime Archaic settlement. It is being rapidly eroded away and artifacts are displaced by the tide and exposed on the beach at low tide. Chipped stones and a fairly well preserved polished slate celt were found in 1979, while 1980 investigations turned up

two nearly complete celts of green slate, two fragments or partly ground slate celts and a small fragment of red slate ground on one surface.

3. Long Islands (DdAj-4)
This site is located in a small cove on the south shore of the middle island of the Long Islands group and is a large and productive Maritime Archaic site with later Dorset Eskimo occupation evidence. Artifacts in 1979 included a large red slate scraper or knife, a fragment of a polished slate spear or lance, a chipped preform for a curved slate knife and several chipped stone artifacts.

4. Sandy Cove (DdAk-2)
This site is located on private property at the top of a high sand bluff overlooking the bathing beach at Sandy Cove. The rapid erosion of the area has unearthed several examples of charcoal, burned bone, flakes, chipped stone and polished stone celts. The site was probably a very popular camping spot from 2000-1500 BC, but there is no evidence of a major Maritime Archaic settlement at the site.

All other sites identified around Terra Nova National Park are of a limited or temporary nature at Ashley Baker Inlet (DcAk-1), Long Islands (DdAj-3), Swale Island (DdAk-8), Park Harbour Point (DdAk-10) and Clode Sound (DdAk-12). The slate knives or scrapers found at Long Islands and Shag Point sites in 1979 are unlike any other artifacts of the Maritime Archaic tradition and most closely resembles the present-day "women's knives" used by the Inuit to remove fat from seal skins.

The Dorset culture had a wide distribution on the Island of Newfoundland and fieldwork in 1979 and 1980 provided further evidence of its existence in the area of Terra Nova National Park on the Island's east coast. Of particular significance was the discovery of evidence of Early Dorset occupation dating back to approximately 500 BC. Artifacts collected in 1979 included several stemmed uniface end blades and other uniface or partly biface articles unique to the area. 1980 excavations added considerably to earlier information and established the Moose Pasture site as a significant archaeological site in eastern Newfoundland. Evidence of living accommodation in the area adds to its significance. Details of the various sites follow.

1. Ashley Baker Island (DcAk-2)
   This site is situated on the grassy southern portion of the most prominent island in Clode Sound and represents one of the most important archaeological sites within park boundaries. The site's elevation is 2-3 meters above sea level and the only disturbance appears to be by lobster fishermen storing their traps on the island over the winter. In 1979 over one hundred flakes of finegrained chert indicated Eskimo rather than Indian occupation and the artifacts found, which included a tiny contracting stemmed projectile point, a thin end scraper, several retouched flakes and two possible burin spalls, suggested that Dorset-Eskimos were present. This was confirmed in 1980 excavations, which produced a total of 12 artifacts and 205 flakes. Most of these were made from black cherts and rhyolites, but there were also several fine-grained cherts and some quartz crystals among the fragments. The discovery of two tip-fluted flakes and the extreme distal portion of a tip-fluted endblade also suggest Middle Dorset Eskimo

occupation in the period AD 1-500. Although the two layers of occupation were mixed and there was definite evidence of occupation by both Early and Middle Dorset peoples, use of the site may not have been continuous.

2. Moose Pasture (DcAk-3)
This site is situated in a small meadow opposite Ashley Baker Island and probably represents the major settlement site for Dorset-Eskimos in Bonavista Bay. Most of the 1979 artifacts were of high quality cherts and bear little resemblance to known Eskimo examples from Middle Dorset sites. The artifacts included fragments of stemmed projectile points, two end scrapers, two microblades, one of which was of quartz crystal, a tiny asymmetric and bifacially retouched sideblade, the stem of a larger knife, a partially ground object, three biface thinning flakes and a small round mass of iron pyrites. 1980 excavations considerably extended the area of the site, which is 4-5 meters above sea level, and indicated a settlement that was larger and more permanent than any other known site. The majority of the 64 Eskimo artifacts collected in 1980 are of Early Dorset origin, although there are specimens from other cultures as well. Over 75% of the 1156 unmodified flakes were of black cherts and rhyolites, although examples of fine-grained cherts, weathered or patinated cherts, speckled cherts, white quartz, white sandstone, Ramah cherts, quartz crystals and purple quartz were also found. Ten endblades found in the sod layer were all triangular and finely flaked and there were also four scrapers, five incomplete prismatic blades, three slightly asymmetric, side-notched knives, a sideblade, two flake knives and a possible core of white quartz. There were also five retouched artifacts in this layer.

Stratum I represents a major occupation and 1980 excavations uncovered numerous flakes and artifacts of various raw materials, scattered charcoal and a total of six features unique to the area. The first feature appeared as a semi-circular pattern of rocks that was found to contain a hearth with a large amount of scattered charcoal. The second also contained a roughly circular hearth with charcoal remains. A third feature was a small concentration of rocks associated with a large concentration of flakes. Just to the west fragments of burnt bone and the large number of chipped flakes indicate a probable chipping area. The fourth feature strongly suggest a hearth in a roughly semi-circular arrangement of rocks, while a fifth could be an extension of the second feature. Charcoal concentrations and possible burnt fat indicate a fairly large hearth. The final feature is an unusually deep layer of loam-like soil with no pebbles, gravel, artifacts or flakes and could have been a foundation for a hearth. A total of 52 Dorset artifacts were recovered from Stratum I and represent a good sample of the tool kit used by the early occupants of Moose Pasture, all types of artifacts being found here.

Stratum II was much less productive with only a handful of artifacts and one feature. This was a roughly semi-circular hearth with charcoal. Burin-like tools were the largest class of artifacts recovered from this layer and all four examples were made from high quality cherts.

In terms of quality, the majority of artifacts recovered show the size and importance of an Early Dorset Eskimo occupation of the site. From a qualitative point of

Stratum I appears as a thin layer of gravel and about half the artifacts are almost identical to those at Moose Pasture and consisted of a finely flaked endblade, four tiny endscrapers and a complete, chipped and ground, side-notched burin-like tool of a high quality mottled chert. These have all been assigned to the Early Dorset period, while three triangular endblades are certainly of the Middle Dorset period and a total of twenty other artifacts, including prismatic blades, biface fragments, two possible quartz crystal cores, a banded chert uniface and five battered or retouched flakes could not be definitely assigned.

Stratum II is a much thicker occupation layer and included a side-notched endblade of the Early Dorset period and three artifacts from the Middle Dorset - a small triangular endblade, triangular tip-fluted flake from Ramah chert and a large triangular preform made from rhyolite. Several other artifacts could not be assigned and surface artifacts included some from the Middle Dorset period.

Other sites failed to indicate the longterm occupation suggested by the two major sites, although there were white chert and quartz flakes at Charlottetown Point (DcAm-1). Preliminary analysis of the finds suggest occupation sometime after 1800 BP by cultures of the Early Dorset period.

The Middle Dorset Eskimo culture in this part of Newfoundland followed the Early Dorset-Eskimo tradition around AD 1 and lasted some 500 to 600 years.

This Middle Dorset period is known from several coastal, and at least one interior, sites. This period is distinguished by distinctive triangular tip-fluted or keeled harpoon endblades, expanding corner-scrapers, asymmetric knives, stone lamps and cooking pots.

The Middle Dorset period is represented in several sites in and around Terra Nova National Park. Details of the major sites follow.

1. The Banks (DdAk-5)
   This site is located on the north shore of Clode Sound east of the Moose Pasture site. Two artifacts and 98 flakes were recovered from the surface of the site in 1979, while six artifacts and 43 unmodified flakes were recovered in 1980. Except for 1979 examples of white quartz and red felsite, all the flakes were of low quality gray and patinated cherts and rhyolites and a small number of colourful high quality cherts. Artifacts consisted of three endblades, a rectangular endscraper, knife fragment and bifacially retouched flake of gray chert and represent a Middle Dorset occupation from AD 1-500.

2. Long Islands (DdAj-4)
   This site on the southern shore of the centre island of the Long Islands group has evidence of occupation by both Maritime Archaic Indians and Dorset Eskimos and is important for both traditions. 1979 investigations revealed two harpoon endblades made from gray felsite and chert and indicated a brief Middle Dorset occupation.

3. Long Islands (DdAj-2)
   This site is located on the south shore of the Long Island's centre island and represents occupation by three traditions. Dorset Eskimo artifacts made of fine-grained gray chert are also typical of the Middle Dorset Period.

The Recent Indian cultures include the Beothuks, their ancestors and predecessors, as far back as the AD 100-200 period. Only two sites in the park produced firm evidence of Recent Indian occupation in 1979, although other sites then and in 1980 revealed a few artifacts that indicated transient or small-scale settlement in the park area. It appears as though the park area may have been abandoned for some time after the Dorset Eskimo occupation, but the more recent artifacts cannot safely be assigned to either the Beothuk or Micmac Indian traditions. Details of the two major sites follow.

1. Sailor's Island (DeAk-6)
   This site is located on the west side of land extending out from Sailor's Island in Eastport Bay. Erosion has resulted from recent occupation of the area and the artifacts and flakes recovered cannot be safely assigned to any particular period of occupation. The small biface thinning flake of chert, partly ground blunt-tipped artifact and partly bifacially retouched chert of felsite projectile point all suggest an Indian culture at some point between AD 1000-1600.

2. Long Islands (DdAj-2)
   This site is related to larger Maritime Archaic and

> Dorset Eskimo sites in the vicinity and has been greatly eroded. A fine-grained banded, gray chert, slightly asymmetric projectile point seems to represent a Recent Indian manifestation, perhaps related to the historic Beothuks, but no definite conclusion has been reached.

1980 excavations revealed several other smaller sites in conjunction with occupations by other traditions. This was particularly evident at the Moose Pasture site, where the possible cultural affiliation of the group could be Early or Pre-Beothuk. This may warrant further investigation on the lines suggested by Sawicki (Sawicki 1981) but this will require a major management decision.

European History

The only permanent settlements located inside the present boundaries of Terra Nova National Park were at Bread Cove in the 18th century, but all surrounding communities were very much involved in the various economic activities going on in the park area. Many of the island communities in Bonavista Bay did not survive the decline of the Labrador and seal fisheries, although Charlottetown benefitted from the same lumbering activity as the other larger coastal settlements adjoining the park. Most European sites in the park vicinity were used in the 19th and early 20th centuries and are of two major types. The first and most obvious sites are those of the numerous sawmills that dot the coastline of Terra Nova National Park. None of the mill sites are in any state of preservation, but Bread Cove could be used for interpretation of sawmill activity in the park as there is an oral history and ample evidence of dwellings. Details of the major sites follow.

1. **Bread Cove Sawmill**

This large historic sawmill complex site is situated on both sides of Bread Cove Brook and is one of the largest sites in the park. Evidence of milling activity includes slabs, sawdust, machine parts and stone foundations and related structures include a bridge across Bread Cove Brook and 19th or 20th century dwelling sites to the west of the mill, marked by vague outlines of structures, cast iron stove parts and other refuse. A 1755 gravestone reported here also indicates permanent settlement at this site. Wes Spracklin constructed a steam-driven mill the late 1800's and initiated a small community that included a school (Rosen 1977). The original mill changed ownership several times and was eventually dismantled. Two water wheel-driven mills were constructed by Musgravetown residents in the late 1920's and early 1930's and a gasoline engine-powered mill was then built by Gideon Greening. Mike Rosen's 1977 study gives very useful information for interpretation of this large complex.

2. **Moose Pasture Sawmill**

This small sawmill site lies to the east of the major prehistoric site, with slabs and sawdust extending to the edge of the brook and into the wooded area to the east. Two collapsed wooden structures, probably related to the milling operation, were fastened with wire nails, indicating a 20th century date, and the preservation of the wood suggests use only a short while prior to the establishment of Terra Nova National Park. The non-altered state of the brook and its banks indicates that the mill was not water-powered, but the evident removal of machine parts at the end of the operation makes the power source difficult to guess.

3. Grassy Pond Sawmill

This site represents another large, recent sawmill on the north shore of Clode Sound, where the brook from Grassy Pond enters the sound. Sawdust and slabs cover a large area and there is evidence of a collapsed wooden structure. Considerable machinery suggests a very recent mill powered by a combustion engine of some kind.

Park Harbour Sawmill

Piles of decaying slabs and sawdust behind the Park Warden's cabin at Park Harbour indicate a sawmill site on the same side of the rapid stream flowing into Park Harbour. This mill was set up by the Reader family from Bloomfield in the mid 1930's and was first powered by a gasoline engine, which was later replaced by a 20 foot diameter water wheel. A 200 foot wooden chute guided the logs from the dam blocking the outlet of the pond inside to the mill site. Foundations may exist on the site, but none have been identified to date.

5. Minchin Cove Sawmill

This site contains several peculiar stone mounds and alignments, the origin and purpose of which are unknown. In October 1976 Robert Ferguson and Birgitta Wallace mapped twenty features of the site (Ferguson 1977). These included thirteen stone piles randomly arranged and enclosed on three sides by field stone walls. A fourth wall nearly bisects the area and there are also two large pits and a furrowed garden plot in the enclosure. A date in the late 1770's has been reported, but no confirmation can be obtained for the local explanation of land clearing for agricultural purposes. There are also reported to be graves at the site (Major 1979).

Jim and George Saunders operated a mill before the King family took over in 1925. This was powered first by a gasoline engine until the mill was destroyed by fire in the early 1930's. An 18 foot high water wheel was used until the mill closed.

6. North Broad Cove Sawmill
This site consists of a poorly-preserved sawmill, evidently water-powered, on the south side of the outlet of Broad Cove Pond into Newman Sound. Slabs, sawdust and the collapsed ruins of the wooden mill structure remain to indicate the mill's location. The mill was operated by Dick Powell of Happy Adventure, who moved equipment from the Saunders mill at Minchin Cove.

7. Salton's Brook Sawmill
This recent millsite is marked by piles of slabs and sawdust by the present picnic shelter. A little further upstream are two recently collapsed wooden structures, that may have been living quarters for the mill hands. Several items of 20th century refuse and portions of at least two cast iron cookstoves indicate the recent nature of the mill, which was operated by Thomas Turner from about 1915. A gasoline engine provided the power source and a 30 foot cable drawn carriage was used for transportation. Remains of the heavy stationary engine may remain in the area, which is suitable for interpretation of the lumbering industry.

8. Upper Sandy Point Mill
The Lane mill at Upper Sandy Point dates from the late 1920's and was initially owned by Walter Squire of Bell Island. George Lane diversified its work to make it one of the most important in the Newman Sound area. A

semidiesel engine operated the mill and in the 1930's and 1940's a Chevrolet truck and then a tractor provided local transportation. Charles Penny from St. John's was granted land here for agricultural purposes, but little cultivation apparently took place.

9. Headquarters Wharf Mill
The last sawmill site is located at Pissing Mare Brook, where Headquarters Wharf is now located. The Squires started their operations in the late 1940's and the first power source was a secondhand diesel engine. In later years a more reliable semi-diesel engine was used. Direct evidence of the sawmill has largely been destroyed and removed in land clearance since the establishment of Terra Nova National Park, but there are artifacts of this and other mills along the Coastal Trail between here and Newman Sound Day Use Area.

Associated with the sawmill sites on Newman and Clode Sounds are shipbuilding yards, although none retain any indication of this activity. Shipbuilding was a major activity in the area that is now Terra Nova National Park, although the two centres were active at different times and with different vessels in mind. Inside the park area at Inner Newman Sound sites, the 84 ton "Fanny S. Horne" was repaired after a fire in 1925, Edgar Dawe built the 51 ton "Episcopus" in 1925 and the 67 ton "E. Dawe" in 1929, William Dyke built the 76 ton "J.C. Squire" in 1934, the same year as William Johnson built the 85 ton "Julia R. Johnson". The last schooner to be built in Newman Sound for the fishery was the 35 ton "H. & M. Hunter" in 1936. Shipbuilding on Clode Sound reached its peak during and after World War I with several yards in operation. Schooners built in Port Blandford and Charlottetown were designed for the foreign fishing trade, carrying dried cod to Europe and the West Indies. These were much larger vessels owned by merchants in St. John's and included several of the largest three-masted schooners built in Bonavista Bay. In the 1920's five such vessels were built at Charlottetown. These were the 300 ton "Florence Squires", 400 ton "Joan Hickman", 420 ton "Marlie Louise", 420 ton "Workśman" and 420 ton "Kinsman".

The final group of sites includes temporary settlements and campsites with "tilts", hearths and temporary fireplaces. Several of these date from the time of sawmill operations or shortly before the establishment of the park. Details of the more obvious sites follow.

1. Platter's Picnic Area
   This site on a low terrace fronting on the sand beach and protected by a steep bank includes several small cobble hearths 10-20 meters from the water's edge and well within the protection afforded by the spruce-fir forest. A wire nail recovered from test pits at the site suggests 20th century use. There is also a single rectangular rock structure with red brick fragments. Two T-head nails recovered from near the centre of the structure could date from the 17th, 18th, or 19th centuries.

2. Tidewaters
   This site is located on a large low terrace at the western end of Clode Sound and contains the remains of two small rectangular hearths contained "tilts", a few traces of which remain. Both are composed of small boulders with a "fireback" of a flat stone slab.

3. **Seal Island**

This small site on the islet between Seal and Swale Islands contains the remains of a small "tilt". Wire nails and the preservation of the wood suggest very recent occupation, perhaps even after the 1957 establishment of Terra Nova National Park.

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RESOURCE EVALUATION

The protection of natural and cultural resources is a primary consideration in the management of Terra Nova National Park. Coupled with this consideration is a requirement to provide the park visitor with an understanding of and opportunity to enjoy this natural and cultural heritage. The development of park facilities and services, consequently, must reflect this dual role of protection and interpretation. Resource evaluation is the logical management requirement to determine opportunities for interpretation of park resources, as well as to designate limitations resulting from the necessity to protect the resource. It is the purpose of this section to provide a limited evaluation of the natural and cultural resources of Terra Nova National Park having regard for the fact that further evaluations will be made from time to time based on more specific planning and zoning. Opportunities for interpretation, as well as constraints, together with notes on management requirements and scientific interest are presented for eleven natural resource components and for the park's archaeological and human history.

CLIMATE

The climate of Terra Nova National Park is characteristic of the eastern portion of the Island of Newfoundland. It is sufficiently diverse that, while creating opportunities for visitor activities on the one hand, it can, on the other hand, impose severe limitations.

Opportunities

Climatic conditions permit normally expected recreational activities such as camping, hiking, canoeing, boating, fishing and swimming in summer, as well as snowshoeing and cross-country skiing in winter. The months of July and August have the warmest temperatures and are therefore favoured for swimming, but late May, June and September can also provide pleasant conditions for the other summer activities. The months of December, January, February and March have about equal snowfall, but accumulations of snow during February and March produce the best conditions for snowshoeing and cross-country skiing.

The birds and sea mammals of Terra Nova National Park are largely representative of a sub-arctic climate, while the land mammals and vegetation are representative of a more temperate climate. This presents an opportunity for the interpretation of the influence of the coastal climate on these more northerly species.

Limitations

While summer months are warm, they seldom reach extremes and nights are generally cool. Consequently, coastal waters and larger inland water bodies remain cold, restricting swimming activity to small, shallow lakes such as Sandy Pond.

Both Newman and Clode Sounds are favoured boating areas. Substantial winds, however, can frequently be a potential hazard to both boaters and fishermen. While ample precipitation and cold water temperatures normally occur throughout the fishing season, some years see water levels reach an extreme low level resulting in stream closure to fishing until conditions improve.

Scientific Interest

The monitoring of acidic precipitation in co-operation with the Environmental Protection Service is presently being conducted at the Charlottetown warden station. Rain collected in an automated rain gauge is shipped on a weekly basis to St. John's for analysis. The resulting data is combined with that of other stations throughout the Atlantic Region and periodically published. It thus becomes available to interested agencies for reference or research purposes.

HYDROLOGY

Terra Nova National Park is well endowed with water having 134 lakes and ponds and 66 stream systems. In addition to these easily definable bodies of water, there are large expanses of bogs and fens which are seasonally saturated, having as integral portions of their structures numerous pools and miniature ponds called flashets. No part of the park is far from the coast, which extends lineally some 60 kilometres.

Opportunities

Recreational opportunities stemming from the park's water system include fishing, swimming, and canoeing. In addition, some hiking trails parallel shorelines and provide aesthetically appealing views at virtually all seasons excepting winters of deep snow. Both bait and fly fishing for trout and fly fishing for salmon are carried on in park waters, especially those in close proximity to trails, internal roads and the Trans Canada Highway. Organized swimming is available only at Sandy Pond, but both Blue Hill and Bread Cove Ponds have beaches that can be reached by hiking. Canoeing within the park is confined principally to the Sandy Pond - Dunphy's Pond watershed. Some park visitors, however, take advantage of the nearby Terra Nova River system to more fully enjoy canoeing pursuits.

Opportunities for interpretation are mainly off-site, that is via colour slide presentations incorporated into interpretive talks. A number of hiking and interpretive trails take advantage of an alignment near water.

Limitations

All water bodies described are potentially attractive for sport fishing, however, some ponds and a few streams, due to being very accessible, may be less desirable than others. Swimming is limited by facility development and suitable beaches. The only beach development is at Sandy Pond. Both Blue Hill and Bread Cove Ponds have beaches, but, in both cases they must be reached by hiking.

Canoeing in the park, other than in the area mentioned, is unlikely as running waters become very shallow as summer progresses, or alternatively are dangerous in times of high flow. Other than Dunphy's Pond, most standing bodies of water large enough to be of interest to the canoeist are fairly difficult to reach. The park does not have an extensive connected series of ponds suitable for a canoe route.

Scientific Interest

There has been considerable study of the water chemistry of standing waters in the park (Kerekes, et al, 1968). This data will form a valuable baseline for future measurements relative to acidic precipitation and increased salinity of ponds in close proximity to the Trans Canada Highway.

Gauging stations on Southwest Brook and Northwest River provide long term data on trends in flows by season or per annum. Acidic precipitation is being monitored at the Charlottetown Warden Station.

GEOLOGY/GEOMORPHOLOGY

The bedrock underlying Terra Nova National Park belongs to the Appalachian Mountain system and is of Precambrian origin. Covered for the most part by a mantle of forest and bog in the western portion of the park, this underlying structure becomes more apparent in the eastern areas through the presence of rock barrens, deep gorges, and coastal headlands. Evidence of glaciation can be readily seen throughout the park in the form of scouring, surficial deposits, erratic boulders, etc.

Opportunities

Interpretation of the park's physiography is best accomplished in eastern areas where exposed bedrock is interspersed by zones of ground moraine. The Blue Hill fire tower affords an excellent point from which to interpret park physiography, in particular, the fjords that intrude deeply into the rugged coastline. In the vicinity of Ochre Hill tower, erratic boulders abound and evidence of both glacial scouring and bedrock weathering may be seen. Evidence of glacial and post glacial land forming processes are found throughout the park and offer excellent opportunities for interpretation. Surficial deposits include ground moraine and drumlinoid ridges which blanket much of the region, especially in the area west of the Trans Canada Highway. Drumlinoid ridges are readily evident from observations at Ochre Hill and areas of outwash are found in the valleys presently occupied by Southwest and Big brooks. Elevated deltas associated with these complexes can be observed in the area of Newman Sound campground.

Limitations

The interpretation of Terra Nova National Park basic geology and geomorphology is hampered to a degree by inadequate access routes to areas of interest. Much of the existing trail system was constructed to accommodate the park's biological rather than physical features. A case in point is the reibeckite granite outcrop at Louil Hill. This outcrop, the park's only body of granite, is relatively inaccessible due to the lack of an official trail or adequate roadside parking. Similarly, direct viewing of sub-soils and bedrock processes along the park's rugged outer coastline is restricted to visitors with their own means of marine transport. A further limiting factor is the occurrence of erosion and slope failure. These may be natural or result from the removal of vegetation for trail development. Stream erosion has generally been moderate with the exception of trails along Southwest and Big brooks. These trails have been undercut by stream bank advancement resulting in restricted access to some areas. Logging disturbances may have resulted in sandy embankments along Big Brook.

SOILS

The youthful soils of Terra Nova National Park have only been developing during the 8000-year period since the last movement of glacial ice. They are often not controlled by local geologic relief and may not be correlated to local bedrock.

Opportunities

Interpretation of the park's organic soils may be made more interesting by their characteristic of preserving plant and other natural materials in excellent condition over long periods of time. These soils may also act as a reservoir for clues, through pollen grain analysis, to changes in vegetation over time. The water-holding ability of organic soils, together with the resulting deleterious effect on drainage, provides ample opportunity for interpretation. A second soil type, the Regosols, due to their extreme youth and dynamism can be interpreted to provide an understanding of special problems of plant life attempting to colonize them.

Limitations

Soil characteristics may impose limitations on specific park developments. In the assessment of these limitations, three categories may be considered as follows: none to slight limitations, moderate limitations, and severe limitations. The first category applies to soils which can withstand development and use of recreational facilities with minimum environmental damage. These soils are found principally in Ecosections A and B and a typical soil in the group is a humo-ferric-podzolic with vegetative covering of black spruce and kalmia.

The second category, moderate limitations, includes those soils whose limitations can be overcome by special planning, design or maintenance. As in the previous category, these soils are concentrated in Ecosections A and B, and support the same vegetative cover with the addition of small areas of white birch. The third category, severe limitations, includes soils having properties whose limitations are difficult to overcome and may require major soil reclamation, special design or maintenance procedures. In general, the ecological damage that would result rules out development on these soils except for trails with protective foot surfaces, such as wood. These soils, which fall into the Regosol, Gleysol and Organic groups are universal throughout the park, being particularly prevalent in Ecosections A, B and D, with pockets in Ecosection E - a section which is fragile for another reason - namely, very thin soils.

FLORA

The predominantly coniferous forest of Terra Nova National Park embraces several vegetation associations with two common ones being closed stands of black spruce and moss, and, open forest of black spruce with ground cover composed of Kalmia and associates. Far less common, and restricted largely to Ecodistrict D, are the stands of black spruce and lichen. Pure stands of balsam fir complete the coniferous segment of the vegetation, occurring mainly in Ecodistricts C and D. The deciduous component of the park's forest cover, a relatively minor one, consists of stands of white birch found principally in Ecodistrict A.

The non-forested ecosites of the park consist chiefly of barren, fen, and bog, occurring throughout all ecodistricts. Significant examples of these are Salton's Marsh and Gross Bog in Ecodistrict A, Fox Pond - Ochre Hill fen, Ochre Hill barren, and Brown Bog in Ecodistrict D. A limited number of marshes and swamps occur on rich alluvial sites. While small in total area, these are important as they add diversity to the landscape and specific habitat for fauna.

Opportunities

Opportunities for interpretations of the flora of Terra Nova National Park include the following:

(1) Successional trends and the impact of such catastrophic forces as wind storms, fire, and insect infestation.

(2) Floristic adaptation to all sites, but in particular to alder swamps, draw fens and salt marsh edges.

(3) Floristic variety and/or diversity which is most apparent in young forests, all-aged forests and marsh types.

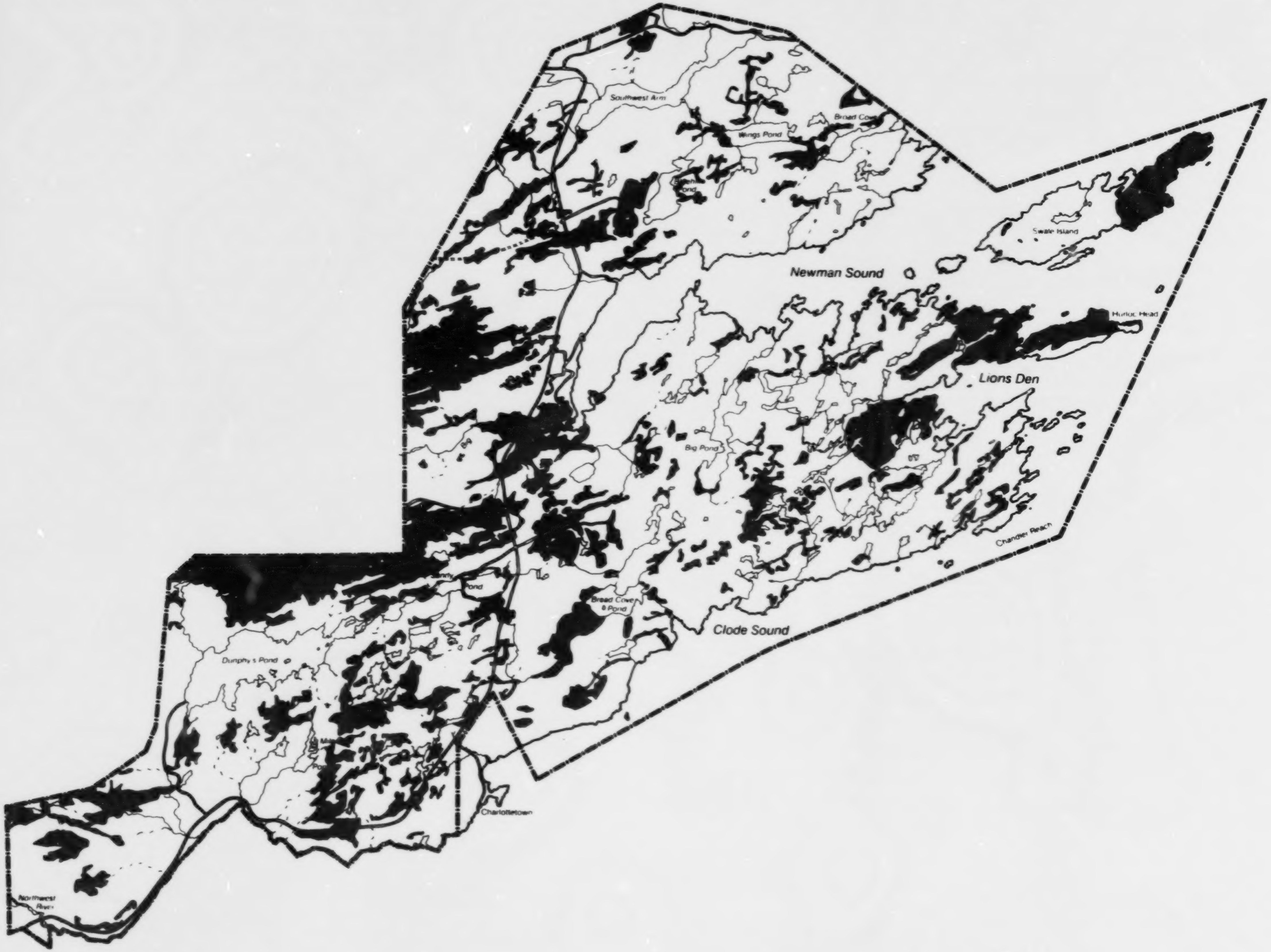
(4) Faunistic activity such as beaver workings, moose feeding, predator spor and sign relating to vegetation.

Additional opportunities for interpretation arise from the rarity of some flora species and associations of species. For example, red maple reaches its northern limit in the park and is restricted to rich swamps or alluvial areas. In addition, an unusual and interesting vegetation association is the balsam fir - rubus - mountain maple mixture.

Limitations - For Development and Use

The ombrogenous bogs and black spruce lichen barrens of Ecodistricts A and E typify very fragile category lands based on vegetation, soil type and moisture regime.

"Fragile" areas are often found bordering these lands and comprise chiefly mesotrophic bogs, swamps, and fresh and salt marshes. In both of these areas, carefully constructed trails are about as intense development as can be permitted. Map E-1 indicates the extent of these fragile lands


Southwest Arm
Broad Cove
Wings Pond
Newman Sound
Swale Island
Hurloc Head
Lions Den
Big Pond
Chandler Reach
Clode Sound
Broad Cove Pond
Sandy Pond
Dunphy's Pond
Charlottetown
Northwest River

Terra Nova National Park

MAP E-1

VEGETATION SENSITIVITY

■- Fragile Areas

Parks Canada
Atlantic Region

kilometers
1 0 1 2 3 4

N

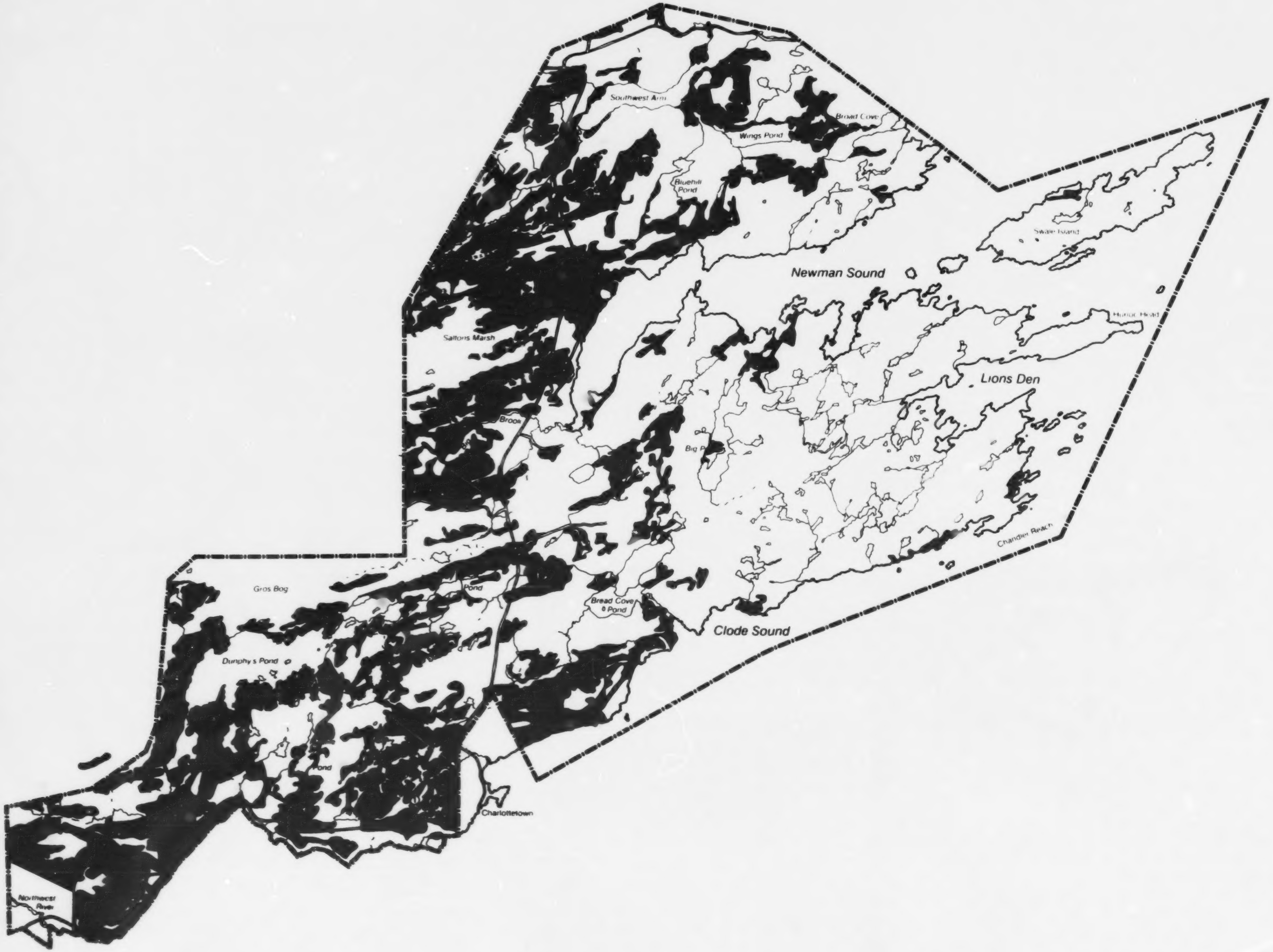
throughout the park. Areas that are tolerant to recreational development from a standpoint of vegetation, slope and soil conditions are found chiefly in Ecodistricts A and B and are shown in Map E-2. This distribution, dynamism, and trafficability of vegetation types in the park are provided in Table E-1.

Limitations - For Interpretation

Interpretation of flora can be carried out to greatest advantage on site. In establishing an interpretation program, several limiting factors must be considered. Chief among these are inclement weather, biting insects, and difficult or lack of access to areas of particular interest. Timing of field excursions can take the first two factors into consideration, while trail construction plans can be based partially on the requirement of improving access to specific areas of flora interest. An additional limitation, but not necessarily an annual one, is the risk of fire. During periods of very high to extreme fire danger it may be necessary to curtail on-site interpretation efforts, particularly in areas such as budworm-killed forest stands where exceptional fire hazards occur.

Limitations - General

The vegetation of Terra Nova National Park may be classified as forest and non-forest. Table E-2 outlines attractions and constraints for each of the principal forest vegetation associations found in the park. Table E-3 outlines attractions and constraints for vegetation found on barrens and wetlands in the park. The information contained in these two tables provides some insight into opportunities for interpretation, as well as possible limitations, of both


Southwest Arm
Broad Cove
Wings Pond
Bluehill Pond
Swale Island
Newman Sound
Hurloc Head
Saltons Marsh
Lions Den
Broo
Big P
Chandler Reach
Gros Bog
Pond
Bread Cove Pond
Clode Sound
Dunphy's Pond
ond
Charlottetown
Northwest River

Terra Nova National Park

MAP E-2

TOLERANCE FOR RECREATION

■- Tolerant Areas

Parks Canada
Atlantic Region

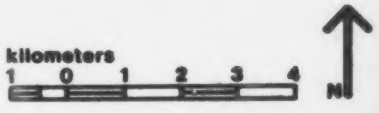

kilometers
1
0
1
2
3
4
N

Table E-1

Distribution, Dynamism, and Trafficability of Vegetation Types of Terra Nova National Park

Vegetation Type	Distribution	Dynamism	Trafficability
Kalmia-black spruce	Matrix of the vegetation cover; found throughout the Park	Transitional except on extreme sites	Durable
Cladonia-Kalmia-black spruce	Coarse soils and outcrops; limited in extent	Stable	Sensitive to trampling
Lichen woodland	Very coarse and dry soils; rare	Stable	Very sensitive
Sphagnum-Kalmia-black spruce	Poorly drained soils; limited in extent, small patches	Stable	Sensitive
Kalmia-white birch	Well drained soils; limited in extent, small patches	Pioneer	Resistant
Pleurozium-balsam fir	Upland soils without seepage; common in the western part	Stable	Fairly resistant
Hylocomium-balsam fir	Seepage slopes; very common	Stable	Somewhat sensitive
Rubus-balsam fir	Nutrient rich, seepage soils; very limited	Stable	Very sensitive
Carex-balsam fir	Moist lower slopes; limited in extent	Stable	Very sensitive
Dryopteris-Lycopodium-balsam fir	Well drained loamy soils; rare	Stable	Moderately resistant

Table E-1 (Contin.)

Vegetation Type	Distribution	Dynamism	Trafficability
Aspen - white birch	Fine textured soils; Big Brook and Terra Nova Brook watersheds	Pioneer	Moderately
Birch on unstable soils	Mainly scree slopes; small stands	Pioneer	Very sensitive
Black spruce-Moss	Common throughout the Park	Pioneer and transition	Resistant
Rock barren	Exposed summits	Stable	Very sensitive
Kalmia barren	Very common	Very long transition if not stable	Resistant
Transition barren	Could occupy any site; limited in extent	Transition	Resistant
Ombrogenous Bog Complex	Commmon throughout the Park	Stable	Moderately sensitive
Mesotrophic Bog Complex	Common throughout the Park	Stable	Sensitive
Seepage Fen Complex	Limited to western part when it occupies large area	Stable	Very sensitive
Draw Fen Complex	Small areas, throughout the Park	Stable	Very sensitive
Beaver Dam Marsh	Very limited	Depends on geomorphic processes	Very sensitive
Floodplain Marsh	Very limited	Depends on geomorphic processes	Very sensitive

Table E-1 (Contin.)

Vegetation Type	Distribution	Dynamism	Trafficability
Estuarine Marsh	Very limited	Stable	Very sensitive
Peat Margin Swamp	Near peat margin, local depressions	Stable	Sensitive
Alluvial Swamp	Along some brook	Stable	Very sensitive
Seepage Swamp	Restricted	Stable	Sensitive

Table E-2 - Forested Land Types: Attractions and Constraints

Description	Attractions	Constraints
Kalmia-Black Spruce	Interesting, irregular surface, heath and lichen flora	Successional changes are very slow, tendency for this type to revert to non-forest.
Cladonia-Kalmia-Black Spruce	Diverse, rich lichen flora, potential caribou habitat	Subject to high potential for fire outbreak.
Lichen-Woodlands (Cladonia-Black Spruce)	An unusual forest type in Newfoundland. Red ants prefer this community to form their colonies.	Adversely affected by a minimum of foot traffic.
Sphagnum-Kalmia-Black Spruce	Lichen and bryophyte floras well developed. Orchids may be present.	A normally high water table causes unstable rooting systems for the tree component.
Kalmia-White Birch	Of interest, because of rarity. Visually appealing especially in fall, when foliage acquires bright colours (birch, maple and aspen components).	Unstable, succession in absence of fire leads to a coniferous forest (typically fir).
Balsam Fir-White Birch	Associated moss flora is varied.	Regeneration, often affected negatively by moose browsing.
Hylocomium-Balsam Fir	Ground flora may be significant	Pit and mound micro relief impede trafficability.
Rubus-Balsam Fir	Lush herb and fern layer.	Soils moist and subject to disturbance.
Carex-Balsam Fir	Floristically very rich (sedges/herbs and ferns)	Sensitive moisture regime, easily disturbed.
Dryopteris-Balsam Fir	Lush herb and fern layer.	Sensitive moisture regime, also fragile plants.

Table E-2 (Contin.)

Description	Attractions	Constraints
Aspen-White Birch	Orchids, violets, lilies and the trillium are herbs that occur here.	Some of plants present are readily disturbed or damaged.
Black Spruce-Moss	Simple and uninteresting floristically; however, where disturbance in the form of logging has occurred, the evidence of this activity has high interpretive value and potential.	Subject to blowdown and invasion by Kalmia.

Table E-3 - Non-Forested Land Types: (Barren and Wetlands): Attractions and Constraints

Description	Attractions	Constraints
Rock Barren	Interesting, because plants are typical of the alpine tundra.	Vegetation very sensitive and subject to disturbance because these communities are often viewpoints.
Kalmia Barren	Important, as a significant feature of the park.	Because of fuel build-up - vulnerable to accidental fire.
Transition Barren	Of interest for interpretation - as an example of secondary succession - common plant - blueberry.	Nil
Ombrogenous Bog Complex	In our climate this ecosystem expands upward and outward, and as such has high interpretive value.	Has low trafficability.
Mesotrophic Bog Complex	Richer floristically than the previous community. May harbour the rare Curly Grass Fern.	Low trafficability.
Seepage Fen Complex	Have varied and interesting surface pattern.	Low trafficability.
Draw Fen Complex	High species diversity, especially of sedges.	Low trafficability.
Beaver Dam Marsh	Contain plants noted for colourful blooms.	Low trafficability.
Flood Plain Marsh	The existence of this ecosystem relates to active geomorphological processes.	A dynamic system, subject to relatively rapid change.

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Table E-3 (Contin.)

Description	Attractions	Constraints
Estuarine Marsh	Importance as feeding and staging areas for waterfowl and shorebirds.	Prevalent organic soils - easily disturbed.
Peat Margin Swamp	Virtually nil (see constraints)	Difficult to travel through on foot, soils waterlogged.
Alluvial Swamp	Rich floristically	Delicate and sensitive to disturbance. Difficult to travel through.
Seepage Swamp	Rich floristically	Very vulnerable to alterations in drainage, and easily damaged by repeat passes by foot traffic.

forest and non-forest vegetation associations within Terra Nova National Park.

MAMMALS

Islands often have fewer species than the nearby mainland and this observation is true of Insular Newfoundland. Counting the now extinct Newfoundland race of the timber wolf, the mammalian fauna of the Island once totalled 14 species. A number of introductions have been very successful, e.g. masked shrew, snowshoe hare and moose. These "new" members of the mammalian group have found The Island suitable to their needs, and in particular have benefitted from a lack of competitors and predators (shrews and moose). A more recent introduction, the red squirrel appears to be expanding in distribution and numbers as did the mammals previously mentioned. Because Parks Canada has a strong mandate to preserve our natural heritage, non-native introductions are a major concern and limitation to the achievement of program objectives. Observation of mammals in their natural habitat provides an opportunity to communicate the values of preserved habitats. Preserved mammal populations and their habitats also provide a wealth of research opportunities and are benchmarks for future comparison with lands modified by man.

Small Mammals (Shrew, Vole, Bats)

The masked shrew is common in most habitats, while the meadow vole is more restricted. Bats (two species) are uncommon since they are on the fringe of their range. Although masked shrews are predators, both it and the meadow vole are important as prey for larger animals.

Opportunities

The main opportunities are for scientific research and interpretation.

Limitations

None identified.

Management Implications

Periodic monitoring will provide insight into the dynamics of small mammal populations and their inter-relationship with predators.

Hare

The snowshoe hare is cyclically abundant in the park and is an important food source for lynx, red fox, and potentially for the re-introduced pine marten. Occasionally showshoe hare are taken by both weasel and mink, while the Goshawk is the important avian predator.

Opportunities

Due to their numbers, hare are readily seen by park visitors at all seasons and therefore offer excellent opportunities for on-site interpretation.

Limitations

None identified.

Management Concerns

While hare are frequently killed on park highways, its bouyant population, however, results in the situation not being considered serious. Recently, an incipient reservoir of a strain of tularemia was found in the local hare population. This situation should be monitored in the future as it may impose limitations on visitor use. Monitoring of population trends is also recommended. In line with this, browse plot surveys should be continued.

Red Squirrel

It wasn't until 1981 that the red squirrel was seen with fair regularity in the park. It represents a potential source of food for the pine marten and other predators.

Opportunities

The presence of the red squirrel in the park provides the opportunity to understand the dispersal of an animal into a new habitat. Red squirrels are usually easy to approach and therefore should be an excellent subject for interpretation. However, due to relatively low numbers in 1983, they will not figure very importantly in visitor programs for a few more years.

Topics for Further Study

The population plots established in 1982/83 will be terminated. Observation cards should be completed for each sighting.

Beaver and Muskrat

Beaver usually occupy all suitable habitats in the park.

There are a number of traditional colony sites, and it has been said that beaver have at one time or another "occupied every watershed in the park". In contrast to the beaver, muskrat are very rare residents in Terra Nova National Park, and reasons for their low numbers or decline are of importance and recommended as a subject for further study.

Opportunities

Beaver are a very high profile attraction to a park interpretation program. In contrast to most mammal species of a similar size, beaver are usually confined to a relatively small area. Their activities are diverse and even these, in absence of the beaver themselves, are of consuming interest to visitors.

Topics for Further Study

The number of active beaver colonies should be monitored annually if possible. Muskrat populations should be studied to determine the reasons for their decline.

Limitations

In at least three cases, beaver activity has interacted negatively with several established visitor facilities: a roadway, a trail and a day-use area. The potential for conflict with beaver should be considered in site planning.

Research and Management Needs

Future facilities should take into consideration potential beaver activities, and their preferred habitats. A beaver management plan should be prepared and updated annually.

Red Fox

Fox are presently rare in Terra Nova National Park. Populations in the Province generally are depressed.

Opportunities

Fox have a minimal effect on vole, hare and other prey species. The status of fox may be a topic of potential interest for interpretation.

Limitations

None identified.

Topics for Further Study

This species should be monitored by track transects, completion of observation cards and other accepted techniques.

Black Bear

The black bear is a relatively common park resident seen regularly by both staff and visitors.

Opportunities

The black bear is a topic of interest to park visitors and should be exploited through the Interpretation Program.

Limitations

Bear/people interactions can be dangerous. Interpretation programming should concentrate on educating the park visitor on the proper attitude, behaviour and procedures to avoid dangerous situations when confronted by bears.

Topics for Further Study

Black bear populations should be monitored through the completion of McBee wildlife observation cards. The relationship between dumps which attract bears near the park and those bears which frequent the park, notably the campgrounds, should be studied. A bear management plan should be maintained.

Mustelids

Mustelids comprise otter, marten, mink and weasel. Of this group, the marten was extirpated in the park, but is currently being re-introduced. The other three members of this family are rarely seen, with the exception of the mink which occasionally is seen at the Headquarters and Saltons wharves.

Opportunities

Opportunities for interpretation are not as great as for other mammal species which are more readily observable.

Limitations

Increased visitor use of the coast may negatively affect successful reproduction by otter, due to disturbance. Throughout the range of the otter, it is a heavily trapped species. Otter are subject to trapping pressure adjacent the park.

Research and Management Requirements

In view of the current re-introduction program of the pine marten, it would be useful to learn more about the interrelationship between this species and the mink. It would also be of interest to learn more of the effect of mink on sea-bird colonies. All mustelids should be documented by Observation Card Reports. Special attention should be paid to otter population trends.

Lynx

Lynx are relatively common in the park, and more often seen than red fox.

Opportunities

As this species is seen quite frequently, it provides enjoyment to a number of park visitors. Lynx are a boreal forest species and not instinctively afraid of man. For this reason it may often be approached quite closely.

Limitations

Lynx may be subjected to a degree of harassment by park visitors and alternately lynx have the potential of posing a public safety problem.

Topics for Further Study

Observation cards should be completed for this species.

Ungulates

Moose are relatively common in the park, whereas caribou, while probably formerly common, are now a visitor of unpredictable frequency.

Opportunities

Moose are viewed with interest by park visitors, photographers, drive-through tourists and others. In late summer and fall there is the possibility to see antlered bulls. Natural history and folklore of moose and, to a certain extent, caribou, add to the material which may form interpretive programs on these impressive animals.

Limitations

Caribou are apparently absent most of the time from the park and adjacent lands for a number of related reasons including human activity causing disturbances, logging and consequent removal of preferred associated vegetative food, and lastly hunting.

Moose are much sought after by poachers; however, a much more serious source of mortality are moose-vehicle collisions on the Trans Canada Highway. Moose cross this highway virtually anywhere along its alignment traversing the park. Moose are not only heedless of the highway itself, but may even be selectively attracted to it by the presence of road salt, and also by ease of travel along it compared to travel through deep snow in the woods.

Research and Management Needs

A proposed research project will investigate vegetative food production for caribou in Terra Nova National Park.

A current research project is examining aspects of moose-vehicle interaction. Recommendations towards reducing the annual loss of a significant number of animals are at this time very important.

Browse exclosures re-measured in 1982, should be measured again in 1985. Moose should be monitored by aerial surveys.

Snow station reports are important in consideration of the management of this species.

Marine Mammals

Potentially there are some 13 species of whales and six species of seals that may be actually seen in waters near the park. In practical terms, only a few species are present in any significant number, and even these are rarely seen by the casual land-based observer.

Opportunities

Ideally, marine mammals are best seen and most enjoyed from a boat. Fortunately, all species lend themselves to off-site interpretation with some success, i.e. they are large, readily portrayed graphically and have been reasonably well studied.

Limitations

The normal environment of marine mammals is usually an abnormal environment for the human observer. This means that there are definite limits to the extent of what may be learned about these animals by the average person. Approaching these animals by boat or aircraft, if not carefully controlled, may result in a form of harassment.

AVIFAUNA

The avifauna of Terra Nova National Park is typical of Canada's Boreal forest region and includes such representative species as the Common Loon, Goshawk, Common Raven, Black-backed Three-toed Woodpecker, Gray Jay, and Fox Sparrow. In addition, drift migrants from eastern mainland North America often result from prevailing west and east weather system movements, and European birds astray over the North Atlantic may find the Newfoundland east coast a suitable landfall.

The relative isolation of Insular Newfoundland has resulted in the development of several subspecies which include the Newfoundland Robin, Newfoundland Veery, and Newfoundland Hairy Woodpecker. These are common to suitable park habitats.

The opportunities and limitations for interpretation, the research and management requirements, together with recommendations are provided in an evaluation of the following avifauna families common to Terra Nova National Park:

Pelagic and Marine Species;
Loons, Waders, Waterfowl, and Shorebirds of Estuaries;

Birds of Prey;
Gallinaceous birds;
Woodpeckers and Holenesting Passerines;
Passerines

Pelagic and Marine Species (Gannets, Cormorants, Alcids, Gulls, Terns, and Sea Ducks)

Gannets, fulmars, petrels, and alcids (other than the Black Guillemot) are usually only seen offshore, although some breeding colonies exist. Both Common and Arctic Terns nest in a number of small colonies on scattered islets around the park shoreline while eiders and gulls nest on Copper Island.

Opportunities

Because colonies of these birds off Newfoundland and Labrador are of major importance to survival of the species, attempts at interpretation within the park should be in cooperation with both federal agencies, such as the Canadian Wildlife Service and the provincial government. As the birds are not readily available for on-site interpretation, interpretive methods such as colour slide presentations must be employed.

Limitations

During most of the reproductive cycles, many of the pelagic and marine species are intolerant of disturbance by man and such disturbance may result in very low productivity. An additional limitation to interpretation results from the remote location of the birds in question.

Research and Management Requirements

To maintain or improve the standing of pelagic and marine species within park boundaries, specific management strategies involving protection, field census, public awareness, and management of natural habitats will be required.

Protection of Existing Colonies: Most colonies are concentrated in a limited area and any disturbance can be critical. Since each species is very selective in its choice of nest sites and is very site loyal, all existing colonies should be given maximum protection which includes a restriction of visitation during the breeding season. Specific limits should be placed on an air corridor through the park, as colonial seabirds are highly susceptible to this form of disturbance. The most critical time is during reproduction until all adults and young have left the colony. Colonial nesting islands, such as Copper Island, Shag Rock, Park Harbour Islands, and Ashley Baker Island, and similar areas should be closed to fishermen between early May and late August. This would reduce the amount of disturbance to the colonies, which at present severely reduces fertility, fecundity, and chick survival.

Field Census of Parks Islands: The present system of tern surveys should be continued and expanded to include all islands within the park boundaries. A detailed management plan is required for this aspect and consideration should be given to devising methods of reducing disturbance to the colonies while maximizing the useful data that can be obtained. One person, preferably the Resource Advisor, should be responsible for all aspects of the plan and data should be evaluated for monitoring of the environment, estimates of species populations, analysis of historical population trends and decision-making in land use, planning and resource management. To avoid disturbance of the colonies, censusing should be limited to two/three trips per season by boat to count the total number of adults and/or the total number of nests with eggs or young. This technique will take advantage of the breeding chronology of the species involved. Everyone involved in the operation should be aware of the requirements and time in the colony should be cut to an absolute minimum and curtailed in very hot, cold, windy, or rainy weather, when most losses are experienced.

Public Awareness: Since over 80 percent of park visitors in the summer are Newfoundlanders, brought up on a tradition of "harvesting" seabirds, it is essential that any resource management of colonial seabirds includes reference to public awareness programs.

Management of Natural Habitats: Since most colonial seabirds are only present in the park for a short period in summer, but require abundant seafood at this time, it is essential that an effort be made by Parks Canada to ensure that marine habitats are as free from water pollution as possible. Acid rain is likely to be of minor consequence in the open oceans, but a lowering of the pH in the park's estuarine and fresh waters could pose tremendous problems for species such as the terns, gulls, and the Doublecrested Cormorant, all of which spend a considerable part of their time in these habitats.

Loons, Waders, and Waterfowl and Shorebirds of Estuaries

The Common Loon is the only loon which is regularly found in the marine waters off the park or as a breeder on lakes and ponds. The American Bittern is the only regularly occurring summer resident in the wading bird group, although related herons and egrets may appear as vagrants. Besides the Canada Goose, there are eleven species of waterfowl, exclusive of sea ducks, found regularly in park waters. There are eight species of shorebirds associated with the estuary, not including rare vagrants however, nor the Common Snipe which is essentially an inhabitant of fens and bogs.

Opportunities

Waterfowl are a prime object of direct visitor involvement and resulting pleasure as they are present in significant numbers over an extended season in accessible areas. The presence of waterfowl and shorebirds in Newman Sound water and shore zones is enhanced by Warden protection, fulfilling the scope of the I.B.P. (International Biological Program) designated site.

Limitations

Waterfowl being wary and highly mobile, rarely seem disturbed by the considerate visitor. The situation with shorebirds is somewhat different, feeding as they do on low tide flats. This characteristic makes them very vulnerable to disturbance by visitors and possibly pets not under control. Harassment at a critical phase of their annual migratory cycle, may subsequently reduce their chances to reach their destination safely.

Research and Management Requirements

Waterfowl are observed regularly during the course of field observations and those remaining until late in the year are tallied as part of the annual Christmas Bird Count.

AE7

Shorebirds are monitored in spring and fall, as part of the C.W.S. Maritime Shorebird Survey. While there are no particular studies in place on the Common Loon, there is, however, a baseline population study under consideration. Important management considerations for this large group of avifauna involves protection of breeding habitat, staging areas, and wintering habitat.

Breeding Habitat Protection: All species require fairly isolated wetland areas, usually ponds, and tolerate very little disturbance during the early part of the summer. Protection of representative examples of the breeding habitat of each species known to occur in the park should be an integral part of waterfowl protection, and, this consideration should be of paramount importance when evaluating backcountry development. Further research on a more formal basis is required before this protection can be assured for some of the more restricted species. In this respect immediate special protection is required for the nesting Common Eiders on Copper Island.

Staging Area Protection: All species found in the park gather in one or two significant staging areas during the spring and fall. These serve two very important functions, without which waterfowl would have problems in maintaining their numbers. In spring, the staging flocks are a social necessity for pair bonding, as most species have highly ritualized communal displays. This is particularly true of the diving ducks, which choose new mates each year, and the loons, which strengthen existing pair bonds on the wintering grounds. Inner Newman Sound receives much heavier visitation from geese and ducks at a time when park facilities are largely closed down. However, the proximity of this area to Newman Sound campground and other service facilities has resulted in a noticeable increase in eutrophication from sewage and other human wastes. This raises strong concerns that continued high intensity use of this area may eventually destroy the waters and organisms of Inner Newman Sound, and Big Brook Flats in particular, and threaten the continued existence of staging flocks in the bird sanctuary.

Wintering Habitat Protection: While not as crucial as the staging areas in terms of social interaction, the open water and estuarine wintering areas are important as sources of food and pair bonding in winter and early spring. Inner Newman Sound and Clode Sound are largely frozen over for much of the winter, but relatively ice-free waters outside the Eastport causeway between Traytown and Southwest Arm are among the most important waters in Bonavista Bay for wintering ducks, including the rather rare and local Barrow's Goldeneye and Bufflehead. Careful management of this area is necessary to ensure that the regular flocks are not deprived of this important habitat and plans to develop the area adjacent to the park require special attention. Other important winter and early spring areas are located to the south of the park at Port Blandford and Shoal Harbour.

Birds of Prey

Birds of prey found in the park include thirteen possible species, nine of which are diurnal and four that are nocturnal. Of the group only the Bald Eagle and Osprey are regularly seen by the casual observer.

Opportunities and Limitations

To many visitors, the sight of one or more Bald Eagles, and/or Ospreys is a thrilling experience. Terra Nova

National Park is fortunate in harbouring a substantial population of both these species. Due to its choice of habitat (thick woods) and its feeding strategy (fast low flight), the Goshawk is not usually observed at the viewer's leisure, in spite of the fact that it is a year around resident and tolerably common. Owls present another problem to easy interpretation; they may call audibly, but being nocturnal, they are seen only by the more diligent observer. On this basis then, our two local species (The Great Horned and the Boreal) are candidates for off-site interpretation.

Research and Management Requirements

Regular coastal patrols indicate that the Bald Eagle nesting success is good to better than average for the species. However, a research proposal suggesting banding, among other things, as a future management tool has been prepared. As tour boats can readily motor quite close to most active eagles eeries, it's important that operators appreciate the pressure under which they can potentially place the birds by approaching closer than 100 meters, or by prolonged pauses at the site, i.e., more than a few minutes. Information on Osprey nesting is currently scanty; however, the population does appear to be a healthy one. We do not have much solid information on the Boreal Owl, and the need to confirm the status of this species is recognized.

Gallinaceous Birds

The two species belonging to this group within Terra Nova National Park are the native Willow Ptarmigan and the introduced Ruffed Grouse. It is anticipated that the introduced Spruce Grouse will soon spread into the park from the north and west.

Opportunities

Dispersal of an introduced species is of wide interest and should form a fertile topic for interpretation. Behaviourly, all three species under consideration are different enough that they provide subject matter for comparative biology or ecology. Essentially, the Ptarmigan is a subarctic species and its presence in association with the Boreal forest is of interest. It is also the only species of bird resident here which has an annual dramatic plumage change.

Limitations

Ptarmigan are "super" cryptically coloured in virtually all seasons, but are particularly difficult to locate in summer in spite of their relative "tameness". This makes them difficult to utilize for direct interpretation. Deliberate foot travel through the habitat of the Ptarmigan or the Grouse species in early summer during the initial stages of the nesting cycle may be unnecessarily disruptive and threatening to the survival of the current year's brood.

Research and Management Requirements

All three species under consideration are cyclic in abundance. Again, all three are protected by cryptic colouration, and while the Ruffed Grouse is the only one particularly wary, it, plus the other two species, are relatively elusive, and often seek heavy cover habitually, particularly when threatened. In consideration of these factors, specific management or research needs do not appear necessary. However, a study of the interactions of all three species when the Spruce Grouse becomes sufficiently well established may be worthy of consideration.

Woodpeckers and Hole-Nesting Passerines

This group of about a dozen species is diverse in both size and morphology and includes woodpeckers, two species of Swallow, two species of Chickadee, the Red-Breasted Nuthatch, and the Brown Creeper.

Opportunities

The cavity nesting preferences of this group (the Creeper generally builds a nest under a slab of conifer bark), are of special interest to many of us. Of this group, only the Tree Swallow resorts to an abandoned cavity made by another species, usually a woodpecker. Most of these species are relatively approachable, so make attractive subjects for bird walks and casual interpretation.

Limitations

Most species in this group could be severely limited to the availability of decayed and partially decayed tree stubs. For this reason, the current park practice of minimum sanitation cutting, and the removal of dead trees only when they pose a hazard to park visitors, such as leaning across a trail, or against a facility, is very appropriate.

Passerines

This is the largest group covered in this evaluation representing approximately fifty species within the following major groups: Flycatchers, Thrushes, Crows and relatives, Wood Warblers, Blackbirds, and all Finches and allies. Such a large and diverse group can be included together because of a degree of correlation in habits, habitats and food their numbers and diversity, this is a particularly effective means of dealing with passerines. Other types of organized studies which may be beneficial are: the Newfoundland Nest Record Scheme, the American Birds and Audubon Christmas Bird Count, Breeding Bird Survey Plots, and the Winter Bird Population Study.

AMPHIBIANS

The green frog, a recent introduction, is the only amphibian in Terra Nova National Park. Although widely dispersed throughout the park, there remains considerable suitable habitat yet to be colonized.

Opportunities

As the only amphibian in Terra Nova National Park, and by far the most widespread on the Island, the Green Frog is the sole representative of an entire, very important class of vertebrates. Amphibians are the crucial link with the aquatic past of all "higher" vertebrates, including man. They have many physiological and behavioural adaptations which help them bridge both the aquatic and terrestrial worlds, neither of which they can do without. These adaptations can be verbally exploited in the Green Frog by park interpreters who want to provide an understanding of the class Amphibia to visitors.

Other aspects for interpretation: 1) the continuing thrust of the species into Newfoundland, a place that has remained closed to amphibians and reptiles since at least the last glaciation. What is the species' niche? What endemic fauna has it replaced? What are the total implications of the spread for the park ecosystem?

sources, and perhaps most importantly a similarity in appropriate management treatments.

Opportunities

Many of the groups under consideration are referred to as "songbirds" (all except Flycatchers, Crows and allies). It is this ability to sing, coupled with the often brilliant colours (breeding season males only), plus their interesting behavioural activities which is a constant delight to many people.

Limitations

A maintenance of a diversity of ecosystems is important to the welfare of passerines. It is interesting to note that the early stages of a Spruce Budworm epidemic is particularly attractive to some Thrushes, most Warblers and some members of the Finch group.

Research and Management Requirements

Management should include maintenance of as diverse a habitat as possible. Local hazards relative to park developments such as large areas of glass in buildings, towers, etc. should be recognized during the design stage.

As a number of passerines are quite restricted, developments proposed for specific sites should be closely scrutinized through the environmental assessment and review process to ensure that species needs are thoroughly considered.

In a monitoring mode, all bird species are assessed through C.W.S. Breeding Bird Surveys and, due to the sheer weight of

Finally, in terms of visitor experience and enjoyment, there is the Green Frog's contribution to the park atmosphere. The Green Frog is one of very few frog species to call during the daytime, even on warm, sunny days. Any watcher who has stood quietly on the platform at the edge of Ochre Hill Pond, when the birds have been stilled by the mid-day sun, has marvelled at their strange, banjo-string-like calls.

Limitations

The Green Frog can only be found in or near water between June and September. Fortunately, this period of time coincides with the park's peak visitor season. Also, the species' diurnal nature makes it easier to arrange. Finally, this species is found in some very accessible locations in the park e.g. Ochre Hill Pond, and the ditches along Headquarters road.

Scientific Interest

The Scientific interest for the Green Frog is focussed primarily on its relatively recent appearance (-100 years) on the Island of Newfoundland (see "Opportunities", above). This frog, like the masked shrew, responded to a vacant niche with an explosion in numbers. Park managers must ask themselves about the implications of the frog's presence in terms of the park's total ecosystem within the national park context.

FRESHWATER AND ANADROMOUS FISH

Terra Nova National Park does not have a wide variety of freshwater or anadromous fish. Of the seven species found in park waters, the brook trout and Atlantic salmon are keenly sought after by sportsmen, and management plans for these two species are being produced.

Opportunities

Opportunities for angling by the park visitor are extensive although a limited variety of species is available. In a few locations there are also opportunities to observe migrating salmon moving upstream in the early summer. Angling also provides an excellent mode for experiencing the wilderness of the park.

Limitations

Angling is limited by the chemical quality of the water and the habitat. In general, Newfoundland waters are unproductive by world standards, therefore fish growth rates are slow. The water and habitat quality varies somewhat between watersheds and some systems do produce good populations of trout and salmon. Excessive angling on some ponds and streams combined with other factors has led to excessive numbers of very small fish exhibiting stunted growth.

Scientific Interest

The park provides an ideal research site for studies of trout and salmon population dynamics. If a selection of water bodies representative of the variety of aquatic conditions in the park could be preserved, i.e. angling prohibited, such control areas would provide examples of natural fish populations for comparison with exploited waters. These protected areas would also provide unaltered gene pools and population characteristics not found in other water bodies.

The areas would be of high value for future research.

TERRESTRIAL AND NON-MARINE INVERTEBRATES

The terrestrial and non-marine invertebrates of Terra Nova National Park have not been completely inventoried nor studied to any extent. Forest insects deemed to be pests have been, and continue to be, chief targets of study and monitoring. As a result of this limited endeavour, little is known of the invertebrate and arthropod component of the park's fauna and its relationship with other life forms. Until they are completely inventoried, their significance to the park will not be appreciated sufficiently to impact on management strategy.

Opportunities

The arthropod fauna of Terra Nova National Park has good potential to be interpreted since it represents the most numerous animal life and the greatest species diversity in the park. Insects also interact in significant ways with other components of the ecosystem since they are pests and parasites, vectors for disease, and food sources for many bird species, fish, amphibians, and some small mammals. These facts coupled with the existence of rare, disjunct, extra limital and "showy" species will increase the interpretive potential of these animals.

Limitations

High concentrations of black flies, mosquitoes and sand flies limit the usefulness of some park areas for recreational development. The presence of foliage destroying insects, such as the spruce budworm, limits landscaping and remedial plantings to such resistant and adaptable plants as alders, kalmia and black spruce. Limited protective management measures are possible for new, disjunct, rare and extra limital species or unique situations that exist in the park until such time as they are revealed by inventory and appropriate study completed.

Scientific Interest

Because arthropods are critical components of the ecosystem, many resource management activities may not be successful if they are not taken into account. For instance, successful vegetation, wildlife and fish management may be dependent in part upon an understanding of the arthropod fauna of the park. The distribution, range extensions and discovery of new species will shed new light on the ecological structure of the park and possibly provide clues regarding the Island-wide status and the present and historical distribution of insects, as well as of higher animal-life forms.

National Parks serve as benchmarks for ecological research, the results of which can be compared to the effects of modern technology on lands outside park boundaries. Since arthropods are often managed extensively outside parks, it becomes important to compare the two (park and non-park lands), not just out of scientific curiosity but also to evaluate the health of ecosystems and to detect the possible deterioration of environmental quality. Invertebrates can thus also serve as valuable indicators of the quality of life around us.

INTERTIDAL MARINE INVERTEBRATES AND FISH

The coastline of Terra Nova National Park extends some 160 kilometers. A wide variety of marine fauna is distributed along these shores dependent upon such factors as exposure, slope, estuarine influence and seasonality. An interesting biological feature is the presence of both "arctic" and warm water animals. Marine fish are typical of those found all along Newfoundland's east coast with the "cunner" being the most plentiful.

Opportunities

The interpretive potential of Terra Nova National Park's marine environment is enhanced by extremely clear water, a great diversity of organisms and the fact that both arctic and southern fauna are found close to each other. In addition, access to shorelines suitable for interpretive purposes is adequate. A marine intertidal ecology study carried out by Hunter and Associates in 1979 provides an excellent reference for an interpretation program. A "self guide" interpretive brochure on the intertidal marine invertebrates, produced by the park's Interpretation Section, is also available to park visitors. Excellent interpretive opportunities result from activities of fish in the park's coastal waters. These are frequently seasonal in nature and include such spectacular events as the spawning or "rolling" of caplin on beaches. This annual occurrence is accompanied by the appearance inshore of larger fish such as cod and salmon. The mid-summer arrival of squid may attract pilot whales to park waters, and in some years, acrobatic humpbacks put in an appearance.

Herring and Mackeral are pelagic fish whose summer and fall wanderings may bring them also into park waters in great numbers. In addition to interpretive techniques utilizing shoreline hikes or boats of various types, snorkeling and scuba diving are possible.

Limitations

Through much of the year, the park's coastal waters are too cold to facilitate interpretive programs for all but the most dedicated or hardy park visitor. In addition, high winds frequently render access to the intertidal zone unwise and possibly dangerous. During severe winter weather, inner sounds are frozen thus barring access. Ice scour may scrape away many sessile plants and animals from the intertidal zone resulting in bare surfaces for extended periods. Many species of marine fauna are microscopic and cannot be readily appreciated. Others are cryptic or so well hidden that they are unlikely to be noticed except by the very experienced.

Some sections of the park's coastline, such as Big Brook tidal flats, are too sensitive to environmental damage to allow an unrestricted interpretive program on-site. Other sections of the coastline, with good interpretive potential, have difficult or impossible access. Interpretive programs involving boating activity must take into consideration commercial fishing operations being carried out in the same area. Such programs must also make allowance for the presence of colonial bird nesting sites in some locations adjacent to the intertidal zone.

Scientific Interest

Of particular scientific interest is the occurrence of the gastropod, Petrocola pholadiformis, far north of any other known location.

ARCHAEOLOGY AND HUMAN HISTORY

The east and northeast coast of Insular Newfoundland was the favoured locality of all pre-contact cultural groups as well as the first European fishermen. The rich resources of the sea were the main attraction, and, even though some diversification has been achieved, the fishery remains to this day the mainstay of many communities near Terra Nova National Park.

Opportunities

Interpretation: Limited archaeological investigations so far suggest that Terra Nova and the adjacent coastal areas contain significant resources with which to interpret the prehistoric and historic human occupation and use of the region and the park. Much of this story is still tentative and incomplete and a comprehensive interpretation program for human history will require substantial research projects on some of the more productive sites such as Moose Pasture.

Resource Protection: At this time, with reference to resource protection, further systematic survey for prehistoric sites in the park is not recommended since the limitations of archaeological survey procedures would make such a project both inefficient and ineffective. A more appropriate course of action would be as follows:

1) Where sites are discovered to be eroding rapidly an archaeological assessment will be made and, if necessary, a salvage excavation project will be undertaken.

2) Where development projects are proposed, the EARP

process, using archaeological staff, will be used to determine what resources exist in the area to be affected and to identify appropriate mitigation measures.

Limitations

The need for resource protection is a significant limitation on the interpretation of the prehistory and history of the park. The threat to resources from both increased erosion and vandalism if large numbers of people are encouraged to visit the sites of archaeological and historic resources means that interpretation must be carried out off-site.

To discourage unauthorized digging and collecting on cultural resource sites, interpretation programs must not include specific site location information in off-site exhibits (specific locations will, of course, be made known to park staff for resource protection purposes).

Individual sites should be signposted with unobtrusive markers explaining the significance of the site and warning that any digging or artifact collecting is illegal.

Scientific Interest

The Bonavista Bay region in general and Terra Nova National Park in particular are areas of primary significance for developing an understanding of the prehistory and early history of Newfoundland. The off-shore food resources and the suitability of the coastline combined to attract human settlement to this area over a 5000 year span. Indians, Eskimos and Europeans all settled here in large numbers yet only the last of these is known in any detail. Important gaps and paradoxes remain to be studied and resolved before we can claim a secure understanding of the culture history, ethnic relations and way of life of the Indian and Eskimo peoples of the area.

To resolve these problems, some of the known sites in Terra Nova (e.g. Moose Pasture) will be of potentially great significance if further excavated and other known sites not yet excavated at all may prove to contain crucial evidence. In addition, further sites may remain to be discovered. At this stage it is not possible to specify which sites will turn out to be the most important - partly because some have not yet been found, partly because some have not yet been dug and partly because the question of importance depends on the state of knowledge at the time of excavation. Nevertheless, it is possible to say that, since the Bonavista Bay region, as a whole, is crucial to the development of our understanding of both Newfoundland and Eastern North America prehistory, the prehistoric sites of Terra Nova National Park itself, those now known and those yet to be found, are a major cultural resource deserving of protection.

NOTES